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ABSTRACT

A summary of the final two-volume report of the Systems Development Project is contained in this document. The project was commissioned by the National Library of Canada to study and design an integrated information system for the library employing, where feasible, electronic data processing. Included are all of the recommendations of the final report, an analysis of the present situation, and activities of the National Library, a description and cost analysis of the proposed information system, implementation requirements, feasibility and advantages of the proposed system, and implications for other libraries and networks. Detailed supporting data, retrospective data, and data on internal problems contained in the final report have been omitted from the summary. (JG)

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AN INTEGRATED INFORMATION SYSTEM FOR THE NATIONAL LIBRARY OF CANADA

A summary of the Report of the Systems Development Project

OTTAWA
NATIONAL LIBRARY OF CANADA
1970

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OTTAWA
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INTRODUCTION

This is summary of the final report of the Systems Development Project commissioned by the National Librarian to study and design an integrated information system for the National Library, employing, where feasible, electronic data processing. Two previous interim reports were published. The final report was presented in two volumes comprising more than 500 pages. Volume 1 contains general background on the National Library, its history and growth, its problems, its services and its part in the Canadian library and research community and in international library networks; a detailed description of the proposed system, its applications and benefits; a cost analysis of the system; and the requirements and a schedule for its implementation. Volume 2 is a set of appendices to the main report, containing supporting and graphic data. In addition a number of working papers have been deposited with the new Research and Planning Branch of the National Library.

The staff of the Systems Development Project was composed of a systems analyst from the Bureau of Management Consulting Services, Department of Supply and Services, Mr. R.H. Bullen, and of three librarians from the National Library, Miss Hope Clement, Mr. Louis Forget and Mr. Paul Kitchen. The Project members were supported in the study by a Study Team composed of librarians from the National Library, chiefly Branch Directors and representative Division Chiefs, who attended a series of progress meetings to discuss and approve findings of the Project and who cooperated with and assisted the Project members throughout its duration. Other officers of B.M.C.S. also assisted in the study of specific problems.

The method employed by the project was to study in detail the present system of the National Library to determine its requirements and problems, the responsibilities of the National Library and their relationship to the services it presently offers, the needs of the Canadian

library community, national and international plans for the use of electronic data processing and for cooperation and communication among libraries, and thus to determine the services which the National Library should be offering.

A study was made to identify present National Library objectives and to relate them to their statutory foundations in the National Library Act in order to establish the validity and legality of each activity and to discover areas where duplication and overlap might occur. The Project also carried out a Work Distribution Study whose final results showed the cost of performing each activity and the classification and level of staff employed in each. All present procedures of the Library were flowcharted and interviews were conducted with the personnel of each organizational unit. A study was made of all National Library bibliographic files, with special attention being accorded to the Union Catalogue, the largest file in the Library. Sampling techniques were used to determine the size and make-up of the various files.

In addition to this intense study of the existing National Library system, its costs, procedures and problems, the Project gathered information on the Canadian library community and its needs as related to the National Library services present and future. This was accomplished by means of replies to a circular letter addressed to 168 Canadian university, public, government and research libraries by the National Librarian at the beginning of the Project, and by visits to a number of government and university libraries by Project members, as well as numerous discussions with librarians and systems analysts throughout Canada and discussions with staff of the Information Systems Office of the Library of Congress. The Project also acknowledges the cooperation of the Committee on Library Automation of the Association of University and Colleges of Canada in the collection of data on library automation in Canadian university libraries which was

of great benefit in conducting the study.

This summary includes all the recommendations of the Report as well as a description of the integrated information system proposed, its cost and its implementation requirements and its implications for other libraries and networks. In addition to omitting much of the detailed supporting data contained in the large report, sections which deal strictly with retrospective data and internal problems of the National Library have been omitted.

Libraries in the process of developing their own systems who require more detailed information on the proposed National Library system may request more information on detailed aspects and applications of the system from the Research and Planning Branch.

It should be stressed that the Report summarized here is now under study by National Library management and that decisions for its implementation have not yet been made.

TERMS OF REFERENCE

1. To study the policies, work procedures, methods and systems of all branches of the National Library, and develop an integrated information system with which the National Library can accomplish its objectives most effectively. The system design will include a detailed plan of implementation, and will incorporate, wherever feasible and practical,

   (a) simplification of present procedures and methods, and

   (b) automatic data processing methods.

2. The study should consider the operational developments, and particularly the trends in automation, of other major libraries and research centres with which the National Library must be associated, especially in Canada and in the United States. The procedures, systems and automation developed in the National Library should, as far as possible, be compatible and complementary to those in associated libraries and research centres.

SUMMARY OF RECOMMENDATIONS

This Report recommends that: -

1. An integrated bibliographic information system for the National Library be developed comprising all the operations of acquisitions, cataloguing, Canadiana, serials control, the Union Catalogue and union lists which permit handling by electronic data processing. The integrated system will operate in a combination of batch and real-time modes.

2. Interim guidelines for basic National Library acquisitions and for retention and distribution of duplicate and other non-current material received by the National Library be provided, subject to change when the final results of the resources and requirements surveys of Canadian research libraries are known.

3. A firm and realistic processing policy be set up to cover all material received by the National Library, based on staff available for cataloguing and the value and probable use of the material.

4. A Processing Decision Unit be set up to route material as expeditiously as possible through the new integrated system and to apply the processing policy to all material.

5. All material processed for inclusion in the National Library collection whether brief listed or catalogued in full be added to the Union Catalogue.

6. Research into information retrieval methods, including retrieval by subject, for use in an automated Union Catalogue be undertaken with highest priority being assigned.

7. A working task force of experts, including persons knowledgeable in Union Catalogue problems, be set up to study and evaluate existing information retrieval methods which bear on the problem and to carry out experiments to determine the best methods.

8. The National Library begin in 1972-73 to develop an automated Union Catalogue by forming a bibliographical data base made up of tapes available from the MARC and RECON projects of the Library of Congress, from other similar tapes available from other sources, such as the British National Bibliography, and from selected Canadian university libraries. Current accessions to the Union Catalogue are to be added to this data base beginning in 1973-74. Matching of records in the present manual Union Catalogue to the automated data base is to begin in 1974-75, thus retrospective conversion will take place by matching against the data base and editing only those records which cannot be matched.

9. A study of the needs of the Canadian research library community for a full bibliographical data bank, the services required from it, the volumes involved and a method of funding such a bank be undertaken as soon as possible in order to provide information on which a decision can be reached on the future development of the Union Catalogue.

10. A policy decision on the services to be provided from an automated Union Catalogue, either a location service or full bibliographic data bank service, be made by 1973-74 at the latest.

11. Standards for the Union Catalogue be drawn up and agreement sought from contributing and participating libraries as soon as possible.

12. The services of the National Library and the National Science Library in regard to the maintenance of current location and holding files of serials, the provision of location service and the publication of union lists be examined with a view to clarification of responsibility, simplification of file maintenance, and complete compatibility of systems for serials in all subjects.

13. A study be undertaken of the effects of the proposed information system on the general reference and public service activities of the National Library, including the effects on organizational units handling the reference service of particular types of materials, such as government documents and serials, which will, with the implementation of the proposed system, be freed from a considerable number of their processing activities. The study should examine organization, policies on provision of service and work procedures in the light of changes which will result from the proposed system.

14. An organization and methods study be undertaken of the service desk, the circulation desk and the interlibrary loan procedures, in order to set up a more efficient manual subsystem that will interlock with the services provided by the proposed automated information system.

15. A study be made, when priorities permit, of the means of publishing Canadian Theses by electronic data processing, and an examination be made of the feasibility of combining theses data with data on research in progress in Canada, to provide a data bank of research in Canada, with computer search facilities.

16. The Union Catalogue be developed as a bibliographic data base to form the hub of a Canadian bibliographic data bank network and that the network, at the beginning, consist of national and local nodes only; all local libraries would contact the National Library directly.

17. The National Library accept the MARC II format for the exchange of bibliographic data.

18. All libraries which are, or will be, contributing data to the Union Catalogue, be immediately requested to provide library of Congress Card Numbers and Standard Book Numbers on their catalogue entries.

19. All libraries converting their catalogue data to machine-readable form be urged to adopt a format compatible with and convertible to the MARC II format.

20. A computer system be chosen with the capacity to process concurrently the batch and real-time programs identified in this report, and that this capacity be verified by simulation of the job mix based on volumes established in the working files of the Systems Development Project.

21. The National Library adopt and announce its automation plans and implementation schedule at the earliest possible date and that it continue to keep the Canadian library community and other interested bodies informed of progress throughout the implementation period.

22. National Library staff should be informed of automation plans in general and should be told of implementation in specific areas, before any changes are actually made. Policy, plans and opportunities for retraining should be announced as soon as possible.

23. The National Library should implement the proposed integrated information system, modularly, over a four-year period, according to the timetable described in Figure 5 for the years 1971-72 to 1974-75.

24. The implementation of the proposed integrated information system for the National Library should be undertaken modularly, in the following order: 1. Acquisitions and Cataloguing, including Canadiana, 2. Union Catalogue, 3. Serials Control and Union Lists.

25. Selected staff of the National Library should be trained as computer programmers and as system analysts.

26. The data processing organization be under the jurisdiction of the Associate National Librarian and that the Chief of the Data Processing Centre report directly to him.

27. The initial appointment be that of Chief of the Data Processing Centre, who should be a computer systems specialist, and the appointment should be at a salary in the managerial level. All the appointments to the project team should then be made under the direction of the Chief of the Data Processing Centre. It will be desirable to appoint the Chief Systems Analyst at an early date.

PART I. THE PRESENT SITUATION

BACKGROUND AND PRESENT FUNCTIONS

The National Library was established on January 1, 1953 by Act of Parliament and is now governed by the new National Library Act which took effect on September 1, 1969.

Centre of a library network

In the 17 years since its inception, the National Library has become the centre of a library network. Through its Union Catalogue and union lists the Library is the central link in national interlibrary loan operations; through its national bibliography it has provided standard bibliographical information on current Canadian books; through its cooperation with the universities, it has achieved bibliographical control of graduate theses; and because of its unsurpassed collection of recent Canadian books, and of periodicals and newspapers, it is a first-rate source for Canadian material.

The main functions of the National Library can be grouped into five categories.

1. Bibliographic Centre

The two fundamental activities are provision of a national bibliography and of a Union Catalogue service. The national bibliography activity consists of publishing a number of lists, the most important being Canadiana which contains in its monthly issues, with annual cumulations, a comprehensive record of books, periodicals and non-print materials recently published in Canada, as well as publications with a Canadian connection originating outside the country. Canadiana contains full bibliographic data, is distributed free to Canadian libraries, has a circulation of 3,000 and is received in 57 countries. Advance Canadiana proofsheets are given a limited weekly distribution to subscribing libraries. As for

retrospective Canadiana, progress is continuing on a bibliography covering the years 1867-1900 which is expected to contain over 20,000 items. The Library also publishes an annual list of theses accepted by Canadian universities and, as well, a Canadian theses microfilming service is offered whereby theses selected by Canadian universities are microfilmed by the National Library and sold.

The Union Catalogue service provides a record of the holdings of over 300 Canadian libraries and supplies locations to those who wish to borrow material on interlibrary loan. Updated at the rate of nearly 5,000 accessions per day, the Catalogue consists of over 7,000 filing drawers containing more than 9 million records. During 1969-70, nearly 80,000 location requests were processed. Akin to the union catalogue is the union list and the Library is involved in a number of union list projects in which serials and newspapers are listed with the names of holding libraries.

2. Collections

The first priority is to collect the nation's literature, which the Library does chiefly by means of legal deposit and purchase. Legal deposit of books was introduced in 1953 and coverage was expanded in 1965 to include all issues of Canadian periodicals; the deposit of phonograph records and audio tapes with Canadian content are now claimed as well. About 67,000 titles have been received on legal deposit since 1953. The library also has important collections of government publications (both Canadian and foreign), serials, and Canada's largest collection of newspapers. The Library's general collection is in the fields of the social sciences, humanities and the arts.

Various surveys on the state of academic libraries in Canada have all concluded that university research collections are grossly inadequate. Vast sums of money are required to build up the resources of these libraries,

and, because funds are not easily available, great care must be exercised in coordinating the development of research collections in order to avoid wasteful duplication. The National Library is assisting in two ways: by serving on a committee of the Association of Universities and Colleges of Canada whose purpose is to suggest methods of coordinating acquisitions programmes; and by carrying out surveys of research collections in libraries to determine the strengths and weaknesses of the nation's research resources.

3. Cataloguing

Access to the National Library's collection is provided by public catalogues, the most important being the divided and classed main catalogue. Because the National Library, as well as carrying on its own purchasing programme, has been the recipient of literally hundreds of thousands of gift volumes, it has not been able to overcome its cataloguing arrears; consequently a system of priorities has had to be set up for processing.

4. Reference

The Library provides a social sciences and humanities reference service to a national clientele consisting mostly of other libraries, scholars and researchers. Bibliographies are compiled for researchers who have exhausted the resources of their home library; a central file of bibliographies compiled by other government libraries is maintained, to lessen duplication of effort. In 1969-70 over 9,000 reference inquiries were received.

Interlibrary lending is an important part of the reference function and the Library with its Union Catalogue forms the center of a network for this purpose; 60 Canadian libraries use telex for interlibrary communication. The Library made over 14,200 interlibrary loans from its own collection in 1969-70.

5. Study and exhibition facilities

Large reading rooms and private carrels serve researchers; spacious exhibition rooms permit the Library to sponsor cultural displays.

EVALUATION OF NATIONAL LIBRARY SERVICES

The National Library has served the country well in a number of ways, but improvements are needed; the crush of future demands will require the Library to adjust its methods of operation and take advantage of new information processing and document handling techniques.

Difficulties have been encountered in providing satisfactory service, especially in the Union catalogue, Canadiana and union lists areas.

Union Catalogue

The Union Catalogue was originally divided into three sections within each drawer, an edited section, a section of revised filing of accessions and an unrevised filing section. As more and more libraries joined the Union Catalogue, the volume of reporting increased sharply and it became necessary simply to transfer new groups of accessions into the back of the appropriate Union Catalogue drawer without interfiling, thus creating new sections. As well, a number of microfilm reels of accessions have never been enlarged and incorporated into the Union Catalogue, although these can be searched on a microfilm reader. There is also a large backlog of unfiled reports. Because of the numerous sections, a number of bibliographers have experienced difficulty in using the catalogue. This difficulty is also experienced by National Library staff who are further handicapped by the fact that only a small portion of the Catalogue is edited and that access is limited to main entry. Despite these problems, the Union Catalogue does provide locations for over 80% of the requests made.

What is of great concern to the National Library, however, is the inefficiency of the operation. Concentrated efforts over the last three years have consolidated some of the files and sections, however over 50% of the drawers still contain more than two sections, new accessions remain in a "master file" for up to two months before incorporation into the

Catalogue, microfilms reels for 17 libraries are still uncut, only 2.3% of the Catalogue is edited, there is no subject, title or added entry approach, and no effective standard for the form in which the accessions arrive.

One of the difficulties encountered in the development of the Union Catalogue has been the question of editing. How much bibliographical detail should be included? Should the Union Catalogue be primarily a location service or should it be a source of full bibliographical detail? Too strict and detailed an editing policy in the past has slowed the growth of the edited section. Editing is now much less rigorous but no study has been made of the bibliographical needs of the users. Alternative proposals for editing are discussed in Part II of this report.

The maintenance function of the Union Catalogue has always been and still is understaffed. Had sufficient filers been available throughout its history, multi-section drawers would not exist and microfilm reels would not be omitted. In 1969-70, 26 man-years were spent in filing and organizing the Union Catalogue. To prevent the backlog from falling any further behind in 1970-71, 33 man-years will be required and in order to completely perform the maintenance function (combining sections and eliminating backlogs) 37 man-years per year would be needed beginning in 1970-71 and rising to 42 by 1974-75.

Canadiana

In 20 years, Canadiana has grown into a monthly publication of over 200 pages providing a wealth of cataloguing detail and acquisitions information to libraries. Not only has the number of entries increased several fold, taking in a broader range of categories including such non-print media as phonograph records and tapes, but the depth of cataloguing treatment has increased. The continuing expansion of Canadiana over the years was in response to demands made by its users. The report on the Canadiana

questionnaire that was sent to all Canadian and American subscribers to Canadiana in 1968 reveals that the most frequent criticisms are: entries appear too late to be of use in book selection and cataloguing and annual cumulations are too slow. One reason for the late appearance of entries in Canadiana is that many publishers are not prompt in sending legal deposit material. The new National Library Act has shortened the time limit for deposit from one month to one week, but even so the Library's records show that many deposit items were outstanding in March 1970. Another factor causing delay is the small staff available to do the acquisitions and cataloguing work. A backlog of over 6,300 items exists, enough entries to fill six issues. The page layout task to provide copy for photo-offset printing involves the laborious hand-mounting of varityped catalogue cards onto sheets. For annual cumulations, catalogue cards for the monthly issues must be integrated and remounted. The staff is insufficient to do this promptly.

The scope, depth and sheer size of Canadiana have increased at a faster rate over the years than the Library's capability of keeping the service up-to-date. Because cataloguing is now more extensive than ever, the ratio of books per cataloguer has dropped. Staff could not be increased accordingly. As well, the old methods of preparing printer's copy by varityping, hand filing and hand mounting are no longer feasible, given the present size of the issues and cumulations. It is necessary for the Library to find a new and more efficient way of producing its national bibliography.

Union list

Staff shortages have also prevented the publication of a badly needed follow-up edition to the interim list of serials in the social sciences and humanities. This list included only currently received titles and

did not show details of holdings for reporting libraries. It is also incomplete; estimates of the total number of serial titles in the social sciences and humanities are as high as 47,000, compared with the 12,000 that appeared in the list. Serials are subject to a high frequency of births, deaths, mergers, and title and other changes. Library holdings change continually. A successful union list programme, therefore, must provide for frequent supplements and cumulations in order to achieve and maintain satisfactory bibliographical control of the serials that qualify for coverage. The National Library has not been able to achieve this with the present support given the project. In addition, decisions need to be made on the format and frequency of future editions and an efficient method of collecting records needs to be developed.

Distribution of duplicates

By distributing duplicate lists, filling "want" lists, and allowing librarians to choose material directly from the shelves, the Library has been able to dispose of a small part of its unwanted and duplicate material. About 39,000 serial issues were given away in 1969-70. The chief problem is finding enough staff to process the growing collection of over 100,000 items. The duplicate collection is growing at a much faster rate than it is being distributed, with the result that this material which is not needed by the National Library, but which would be useful elsewhere, occupies more than two miles of shelving.

CONSEQUENCES OF STAFF SHORTAGES AND EXPECTED GROWTH OF DEMANDS

Staff shortages

It is clear that the biggest single obstacle to providing adequate services has been the general shortage of staff. It becomes evident, when one compares the responsibilities of the Library with the number of

personnel provided to carry them out, that the Library has been understaffed from the beginning, especially in its formative years. In 1964, after construction of the National Library building was underway, the staff nearly doubled and since then annual increases have been fairly substantial. Direct services to the Library's clientele are not all that have been impaired by staff shortages, for consequences have also been felt in the organizing of the Library's collections.

The enormous backlog of uncatalogued and therefore inaccessible material, together with an expanding acquisitions programme forced the Library in 1959 to begin brieflisting all but the most important material. Between 1959 and 1968 when the practice stopped, over 100,000 titles were brief-listed only; 80,000 books and 20,000 pieces of sheet music have not been given any cataloguing treatment, and 88,000 titles represented in the main National Library author/title catalogue are without subject approach.

The Serials Division is burdened with a huge and growing backlog of unorganized material. An undetermined number of unopened boxes of gifts is accumulating and in 1969-70 nearly 119,000 miscellaneous items were unboxed, some to be retained and the remainder to be added to the duplicate collection if and when staff can be made available. Similar difficulties exist in the Government Documents Division where several hundred unopened boxes of gift material have piled up. No records exist for a large percentage of the document collection.

The location and reference services of the National Library have been successful in meeting demands, but this is only because staff have been seconded from other duties to keep these services from falling behind.

A number of reasons account for the slow growth of the National Library staff. At the beginning, building and space was at a premium.

Plans for the new National Library were completed in 1957, but a number of setbacks, beyond Library control, delayed construction and the official opening of the building was about six years later than originally anticipated. Another reason why the staff grew slowly was simply that the demand for librarians far exceeded the supply in the 1950's.

These severe personnel shortages of the past have led to a situation where the postponed tasks of yesterday will have to be done tomorrow at tommorrow's prices and on top of the normal day-to-day workload brought on by continuing and increasing demands.

Expected growth of demands

Aside from the federal government itself, universities and colleges are the heaviest users of National Library services. Statistics on the growth of universities and colleges and on the activities of their libraries, therefore, may be used as a barometer to help predict future demands for National Library services.

It is clear that expansions in enrolment and faculty staff increase the demands made on university and college libraries and cause them to buy more and borrow more. In turn, at the National Library, accessions to the Union Catalogue, location requests and interlibrary loans all rise. Studies, for example by the Economic Council of Canada, make predictions on the growth of universities and colleges. Full-time undergraduate and graduate enrolment is expected to soar in the next few years. In 1975-76 undergraduate enrolment will have increased over the 1965-66 level by 152 percent and graduate enrolment by 274 percent. Faculty will increase accordingly.

With this explosion it can be expected that interlibrary loan transactions and library holdings will mushroom as well. Programme forecasts and other estimates show that over the next five years accessions to the Union Catalogue will nearly double, interlibrary loans will

quadruple, reference enquiries will nearly triple and the current cataloguing workload will come close to quintupling.

Clearly, the National Library can expect demands on its services to continue burgeoning over the next five or six years. To keep from collapsing under the weight of these demands, the Library has no alternative but to increase its staff substantially and take advantage of modern information processing methods.

MAJOR NATIONAL INFORMATION REQUIREMENTS

Vast distances, generally sparse collections, and incomplete bibliographical control over printed and other contributions to knowledge are three main reasons why the library user is not always able to get the exact material he wants when he wants it. A number of studies published over the last three years have enumerated the shortcomings of library services in Canada and have identified requirements on a national level that must be met if this country is to achieve a satisfactory library and information service. These studies speak of the need to develop automated information networks by means of which scarce resources could be shared and data bank information could be communicated instantaneously. The notion of a "network" is not new to libraries, and to compensate for their lack of self-sufficiency, libraries have developed successful conventional networks through the use of the postal service, the telephone, the teletypewriter, and a world-wide inter-library loan system.

The Macdonald Report sees the need for a national system of information transfer based on a machine-readable national union catalogue. A second requirement which is really part of the network concept is the effecient transfer of the contents of books, periodicals, reports, microtexts, etc. from remote locations to the user. This type of transfer is covered

generally by the term "interlibrary lending". The efficiency of information transfer is really the key to the efficiency of an information network as a whole, because no matter how quickly an item is identified and located, the system is nearly useless if the item cannot be put in the researcher's hands when he needs it.

In many libraries inadequate attention is given to the interlibrary loan function with the result that it is understaffed and badly organized. Even if a library has a requested book and is willing to lend it, it may take several days for the book to be cleared, retrieved, recorded and mailed. Slow passage through the postal system is a separate difficulty. In the future, telefacsimile transmission may be a partial answer to the problem of transmitting printed information quickly. At present telecopiers are available and the quality of reproduction of material is satisfactory but costs are high.

Related to the transmitting of the contents of books between libraries is the copyright question. The key issue as far as the library community is concerned is the definition of the term "fair use". In a brief to the Senate Special Committee on Science Policy, the National Librarian recommends that the Copyright Act be ammended so as to explicitly permit libraries to make copies and microfilm copies and to "communicate copyrighted material to other libraries by telephotography". It is evident that with the emergence of widespread copying and telefacsimile transmitting of library resources, the Copyright Act should be clarified.

Another national requirement is for comprehensive indexing and abstracting of Canadian publications; a selective dissemination of information system serving researchers in the social sciences is needed, as well as a central up-to-date file on research-in-progress in all fields.

An obvious need of Canadian libraries is for cooperative processing of newly acquired materials. Since professional cataloguers are in short supply, acquisitions are increasing, and cataloguing costs are high, it is desirable for Canadian libraries to avoid duplicating original cataloguing and to share their efforts in such a way that once a book is catalogued by one library, cataloguing data for it would be available immediately to all other libraries.

If automated information networks are to be developed and cooperative processing achieved, a national coordinating agency of some form will be required. The Government has, in fact, designated the National Research Council as the coordinator for the development of a national scientific and technical information system under the general direction of the National Librarian. One question that needs to be resolved is whether there eventually should be a separate non-science system or whether the ultimate goal should be a single total information system embodying information services and sources from all fields of knowledge. Even if two separate systems do develop side by side in Canada, the interdisciplinary nature of research today and the very overlapping of science and technology with the social sciences will clearly make it necessary for close coordination of services, resources and planning to take place.

THE PART OF THE FEDERAL GOVERNMENT IN RESEARCH AND POST-SECONDARY EDUCATION

The federal government is heavily committed to both research and higher education. In 1968-69 the government spent nearly $500 million on research and development, an increase of 83 percent over the total expenditure just four years earlier. The Education Support Branch of the Department of the Secretary of State has compiled figures on federal expenditures on research in the academic community; in 1967-68, these expenditures exceeded $100 million.

As well as supporting research in the academic community through such means as contracts, grants and awards, the federal government is deeply involved in the maintenance of post-secondary education in general. The principal mechanism by which the government assists this level of education is Part II of the Federal-Provincial Fiscal Arrangements Act, 1967. Basically it provides for fiscal transfers to the provinces in relation to their post-secondary educational operating costs. The formula for payments is 50 percent of the operating costs or $15 per head of population whichever is greater. These expenditures do not, of course, include capital costs of land, buildings or physical plant facilities, nor do they include student financial aid, interest depreciation and a few other items. Purchases of library books and periodicals are, however, covered. Once a province has calculated the operating expenditures for the year it must make two deductions: all amounts received for assisted, sponsored or contract research no matter what the source and all other payments received by post-secondary educational institutions from the federal government and the Canada Council.

Payments are made to the provinces which have the right to use the funds as they see fit and are indeed under no obligation to use them for educational purposes at all. However, the Act does encourage the provinces to increase post-secondary educational expenditures through the option of the 50 percent route. The provinces are guaranteed that their expenditures will be matched by the senior government. In 1967-68 federal payments through this arrangement amounted to nearly $387 million. Total federal support of post-secondary education in that year exceeded $431 million.

Direct support of university and college libraries was given by the Canada Council in the form of grants to university libraries for research collections and grants for library construction. The Council provided up to about $1 million per year to university libraries to help them build up resources in the social sciences and humanities for the use of departments undertaking advanced research and offering graduate studies. In the four years from 1965-66 to 1968-69, Canada Council grants for library research collections totalled $3,068,100. In 1957 the Council established a University Capital Grants Fund to which the federal government contributed $50 million. The entire fund was committed by March 31, 1969 and total grants were $68,346,179. Of this amount, it is estimated that $9,257,000 was used for library construction.

As for indirect library support, the federal government's contributions are by way of the Federal-Provincial Fiscal Arrangements Act described above. The latest data available, for 1967-68, in the D.B.S. survey of academic libraries shows that the current operating expenditures for 58 reporting institutions were $50,832,990. If it assumed that all provinces took advantage of the 50 percent formula, then the federal government's indirect share of university and college library operating costs in 1967-68 amounted to $25,416,495. Assuming that the senior government will continue to support post-secondary education using a formula similar to the present one, and assuming that current predictions on future enrolments at university are valid, the federal government's share of university library costs will be more than $100 million in 1977-78 or a cumulated cost over a nine-year period (1969-70 to 1977-78) of more than $600 million.

This is a brief review of the federal government's interest in research, post-secondary education and university and college libraries.

As research and academic activity increase, the demands made on libraries rise proportionately. Consequently the workload of the National Library in providing locations, maintaining the national Union Catalogue, answering reference enquiries and making interlibrary loans rises also. Table 1 is a list of all Canadian libraries with budgets exceeding $1 million in 1967-68, the latest year for which complete figures are available, and shows that the National Library occupied 13th position. The Library's budget for that year expressed as a percentage of indirect federal expenditure on university and college libraries for the same year is only 6.4 percent.

It has been shown in this part of the report that the National Library has a central function in coordinating the flow of research information in Canada but that, because of lack of resources, it has been hard-pressed to provide even basic services until now, not to mention the crush of future demands. It was pointed out that the government commits huge sums to research and development and post-secondary education which in turn escalate demands on the Library. The conclusion to be drawn from this examination is that the financial support given to the National Library is way out of balance with federal expenditures on other academic, research and research support activities and is not large enough to enable the Library to truly fulfill its national role.

The high volume of repetitive information handling in many areas of the Library and the need for high-speed information transfer on a national scale are clues to the feasibility of an automated system for this institution. The following parts of this report describe in detail a proposed integrated computerized system and include an

TABLE 1

Budget of Large Canadian Libraries, 1967-68 -$-

LIBRARY	TOTAL BUDGET	BOOK BUDGET	RANK
UNIVERSITY OF TORONTO	6,905,812	2,026,409	1
TORONTO PUBLIC LIBRARY[1].	3,940,036	527,652	2
UNIVERSITY OF ALBERTA	3,102,071	1,475,122	3
UNIVERSITY OF BRITISH COLUMBIA	3,098,862	1,011,181	4
UNIVERSITE DE MONTREAL	2,723,814	1,043,648	5
NORTH YORK PUBLIC LIBRARY[1].	2,556,302	423,639	6
UNIVERSITY OF WESTERN ONTARIO	2,152,366	961,389	7
VANCOUVER PUBLIC LIBRARY[1].	2,151,791	205,166	8
MCGILL UNIVERSITY	2,095,874	561,228	9
UNIVERSITE LAVAL	2,026,734	630,420	10
SIMON FRASER UNIVERSITY	1,781,976	743,853	11
YORK UNIVERSITY	1,664,166	930,570	12
NATIONAL LIBRARY	1,620,000	250,000	13
MCMASTER UNIVERSITY	1,613,051	713,714	14
DALHOUSIE UNIVERSITY	1,537,715	746,642	15
QUEEN'S UNIVERSITY	1,414,082	555,314	16
UNIVERSITY OF CALGARY	1,410,000	691,000	17
BIBLIOTHEQUE MUNICIPALE DE MONTREAL[1].	1,372,196	182,646	18
UNIVERSITY OF SASKATCHEWAN (SASKATOON)	1,334,993	519,805	19
UNIVERSITY OF VICTORIA	1,300,316	581,358	20
UNIVERSITY OF GUELPH	1,262,262	530,775	21
UNIVERSITY OF WATERLOO	1,233,261	630,360	22
UNIVERSITY OF OTTAWA	1,198,098	583,526	23
UNIVERSITY OF MANITOBA	1,191,773	436,316	24
CARLETON UNIVERSITY	1,156,684	450,104	25
UNIVERSITY OF WINDSOR	1,108,784	586,711	26

1. Expenditures are for the year ending Dec. 31, 1968.

Sources: Canada. Dominion Bureau of Statistics. Survey of libraries, Part II, academic libraries, 1967-68. Ottawa, 1970 (Cat. no. 81-206) p.23-24, and public library annual reports. (Information for 1968-69 in D.B.S. preliminary release, January 1970 is incomplete and is not used)

analysis of the cost of the system and the benefits to be derived from its implementation. When viewed beside the $100 million that the government will lay out in 1977-78 alone for university and college libraries, and when the potential for savings in these library expenditures as a result of an automated system are examined, the investment in such a system would appear to be a modest and wise one.

There are five main reasons why the National Library should automate:

1. Automation will play a large role in curbing future expenses of academic and other libraries

Unnecessary duplication of book purchases is one significant factor contributing to the rapid increase in university and college library expenditures. Universities across Canada are now paying more attention to the idea of coordinating the development of graduate programmes and much of the input to this coordinating activity will be from the university libraries. Under such a plan, the building up of a specialized and comprehensive research collection in one library would not be repeated by another library in the same region, or possibly in the country, without convincing reasons. This broad approach to collection development combined with a thoroughly streamlined method of book location and interlibrary lending would result in the maximum utilization of the resources of academic libraries. For such a plan to be implemented, there needs to be a complete, easily accessible data bank of the holdings of all university libraries which, in addition to giving locations, would quickly provide collection development decision-makers with information on the characteristics of individual collections - that is, there is a need for an automated union catalogue.

Economy through cooperative processing is another factor that cannot be discounted when analyzing the benefits of an automated union catalogue. It would be feasible for libraries to contribute full cataloguing data in machine-readable form to the Union Catalogue and to retrieve from it

the cataloguing copy they need to catalogue new books. Only one library would need to do original cataloguing for each title; thus a reduction in overall cataloguing costs would result. Such a data bank could store machine-readable national bibliographical data from many countries, including our own. Libraries not on-line could have access to this data by subscriptions to MARC tapes; a Canadiana card service would be available. Thus, the chief economic benefits of an automated Union Catalogue and national bibliography, would be in the areas of collection rationalization and cooperative processing.

2. Automation will enable the National Library to provide needed new services and improve existing services

In addition to cooperative processing, instantaneous locations and assistance in collection development, a number of other new or improved services could also be offered: access to the Union Catalogue by several approaches; selective lists from various machine-readable-readable files; frequent cumulations of regular National Library publications including Caradiana, Canadian theses and the union list of serials and newspapers; management reports on the performance of the system, identifying bottlenecks and backlogs and providing many kinds of statistical information.

3. Automation will lead to economies in the National Library's internal operations

A detailed comparative cost analysis, projected over the next ten years, of the continuation of the present manual system and the implementation and operation of the proposed automated system has been made. The implementation of the proposed system consists of three modules, Acquisitions and Cataloguing, Union Catalogue and Serials and Union Lists, each of which is costed separately and compared with its manual equivalent. Considering all modules together, and adding overhead, by 1979-80 the cumulated cost of

an automated system, choosing the alternative of a Union Catalogue with records of an average of 314 characters each, would be $750,000 cheaper than the cost of the present manual system. But these savings are misleadingly low, because in the comparison, the continuation of the present operation of the Union Catalogue is assumed for the manual system and both National Library management and outside observers agree that the present Union Catalogue is inadequate and must be improved regardless of whether a computer is used or not. A fairer comparison, therefore, would be between an automated overall system and a manual system with an improved manual Union Catalogue. When such a comparison is made, the savings to be derived from the automated system are in the order of $2 million, excluding other intangible savings to be gained from the provision of new and improved services.

4. Automation will enable the National Library to be a leader in Canadian library development

The trend in library development is towards automation. This new involvement calls for standardization and communication of bibliographical data in machine-readable form on a national and international level, and these goals can only be achieved under the aegis of a strong and influential body. To assume such a leadership role, the National Library itself must be committed to the advancement of feasible, well-founded computer applications and be prepared to stimulate cooperative efforts in the field.

5. Automation will prevent the National Library from suffocating

A new approach to information processing and document handling is desperately needed if the Library's operations are not to be smothered by uncatalogued books, unfiled cards, and unshelved serials and documents. Staff increases alone are not the answer. The solution to the National

Library's systems problems, in the opinion of the project team, lies in automating high-volume, repetitive tasks.

Summary to Part I

1. Williams, Downs, Tyas, Macdonald and Katz have all enunciated the need for the National Library to assume a leading role in Canadian library development.

2. Demands on the Library are increasing at an alarming rate.

3. The Library is unable to cope fully with these demands.

4. Modern automated methods offer a solution.

5. The cost of these methods is small in relation to total indirect government contributions to university and college libraries.

PART II. THE PROPOSED SYSTEM

AN INTEGRATED INFORMATION SYSTEM FOR THE NATIONAL LIBRARY

Information flow and system summary (Figure 1)

The proposed National Library information system combines on-line and batch processing and is based on a flow of bibliographical information which is recorded in machine-readable form at the point of origin, Acquisitions, passed on to the cataloguing process and finally, in definitive form, for the use of Reference and Public Services. Processing results in either manual or machine-readable files or printouts which make bibliographical information available to staff and patrons within the National Library and to persons outside the National Library by means of on-line terminals and printed catalogues. No usable data is wasted, outputs from one part of the system become inputs at a later stage of the system.

The proposed system is composed of five main subsystems, the distinction being made by functional rather than by organizational divisions. These five subsystems are: Acquisitions, Cataloguing, Serials Control, Union Catalogue and Union Lists. These functional divisions cut across present organizational lines of the National Library, but it is quite feasible for them to continue to do so. The new integrated system does not determine where the work is to be accomplished, but how it is to be accomplished, and as long as the flow of information is kept moving, it does not matter what organizational lines it may have to pass.

The Acquisitions Subsystem covers the selection, ordering and other methods of acquisition of the resources of the National Library. The Cataloguing Subsystem comprises all bibliographic processing of all items received in the National Library including all types of material. This subsystem produces a basic machine-readable record which then can be used to produce catalogue cards, book catalogues, tapes for publication of

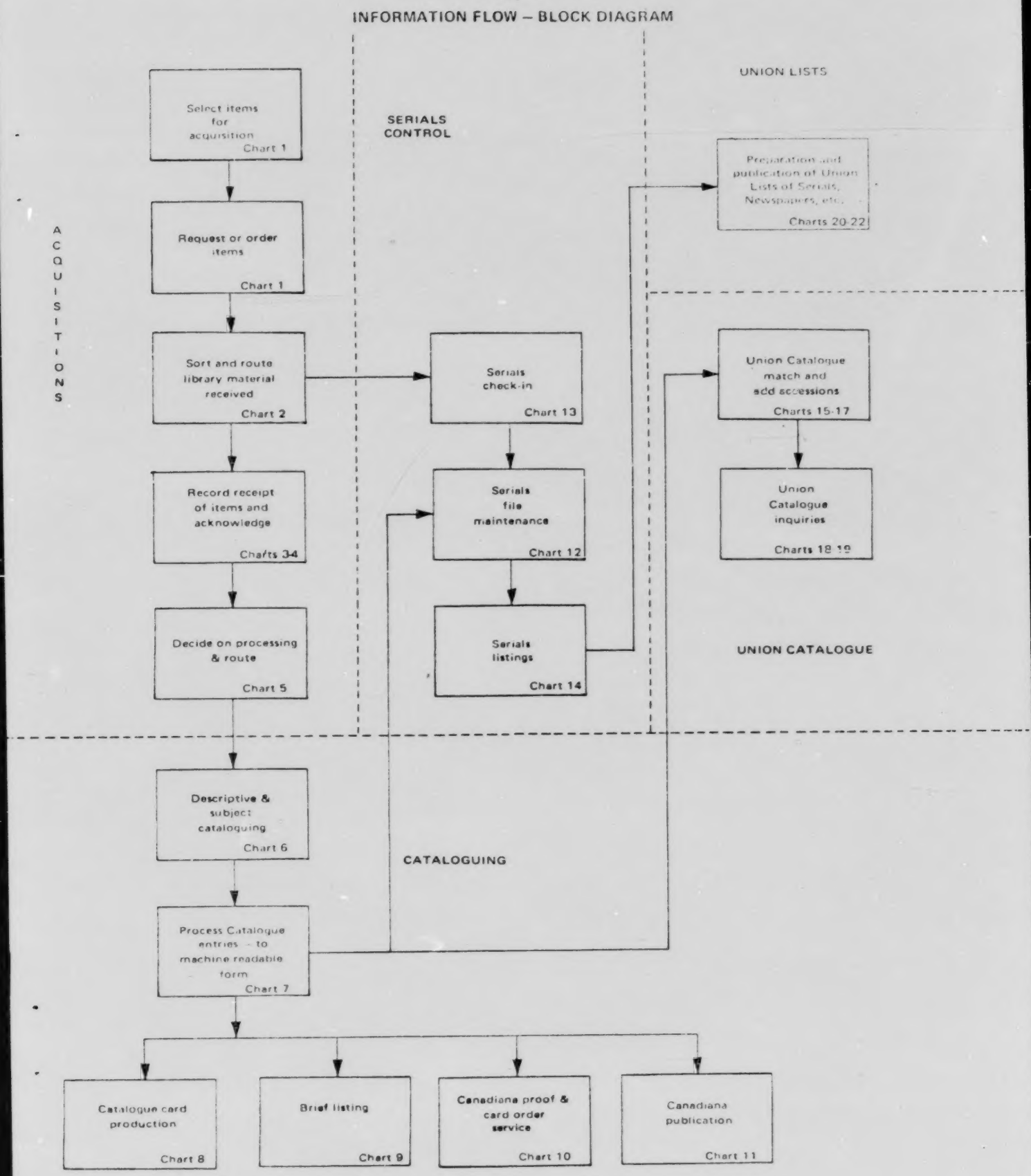
INFORMATION FLOW – BLOCK DIAGRAM
ACQUISITIONS
SERIALS CONTROL
UNION LISTS
UNION CATALOGUE
CATALOGUING
Select items for acquisition Chart 1
Request or order items Chart 1
Sort and route library material received Chart 2
Record receipt of items and acknowledge Charts 3-4
Decide on processing & route Chart 5
Serials check-in Chart 13
Serials file maintenance Chart 12
Serials listings Chart 14
Preparation and publication of Union Lists of Serials, Newspapers, etc. Charts 20-22
Union Catalogue match and add accessions Charts 15-17
Union Catalogue inquiries Charts 18-19
Descriptive & subject cataloguing Chart 6
Process Catalogue entries - to machine readable form Chart 7
Catalogue card production Chart 8
Brief listing Chart 9
Canadiana proof & card order service Chart 10
Canadiana publication Chart 11

Figure 1

Canadiana, bibliographies, etc. as required. The Serials Control Subsystem comprises the maintenance of serial records, the checking-in of new issues and the production of various lists. The Union Catalogue Subsystem consists of the creation, maintenance and operation of the Union Catalogue in machine-readable form, including the addition of accessions and the answering of inquiries. As the Union Catalogue will contain a data base of MARC records it can provide input to the Cataloguing Subsystem. The Union Lists Subsystem produces union lists of serials and newspapers. These five subsystems are all capable of producing various management information reports for monitoring and statistical control of the system.

The Reference and Public Service activities of the National Library will remain largely a manual activity as at present except for facilities for on-line querying of machine-readable files, and for automatic production of bibliographies and lists on demand.

ACQUISITIONS SUBSYSTEM

The Acquisition Subsystem includes the selection and ordering or other acquisition of all types of material, monograph and serial , print and non-print, the receipt of all material by the library and its pre-processing, the making of decisions on the type of processing each item is to receive, and the passing on of all bibliographic information available to the cataloguers. It will be based on an on-line disk file, but most processing will be done in the batch mode.

The on-line On Order/In Process File will contain records for all items that are either on order or have been received by the Library; items will remain on the file until they are fully processed when they will be removed. Processing status will be continually updated so that an item can be located at any point in the system by real-time querying of the file.

After items have been selected and approved for purchase, an Acquisitions Work Slip will be prepared, the item will be searched, verified, a National Library Control Number assigned and the data will then be keypunched. The resulting Order Cards will be batch processed and posted daily to the On Order/In Process File and once a week Purchase Orders will be printed as well as any claims for orders or serials not received. An On Order Listing will also be produced against which incoming orders can be checked. All current material will be received at a central point, sorted and routed for pre-processing. Serials will be sent for Serials Check-in by on-line terminal. Orders will be checked against the listing, deposits and gifts will have receipts made. Note of items received will be made on a copy of the Order Slip (if returned with the item) or on an In Process Worksheet. Ordered items which are not filled or are incorrectly filled and must be returned to the vendor will have an On Order Update Slip made and sent to be keypunched to update the On Order/In Process File.

Items, accompanied by a slip or worksheet, will be sent to the Processing Decision Point, a small organizational unit charged with deciding how each item is to be processed (catalogued in full, brief listed, etc.) and with determining its routing. The unit should be provided with firm acquisition and processing policies on which to base its decisions. Although a firm National Library policy for acquisition of library materials cannot be developed until the resources survey of Canadian research libraries, presently underway, is complete, some interim guidelines should be established especially regarding the handling, retention and distribution of duplicates. In addition, it is essential that a workable policy for the processing of material be developed. With the present manpower available for cataloguing and with the expectation of continuing problems in obtaining a sufficient number of competent cataloguers to fully process all material, it is vital to evaluate the various types of material received by the Library and to

decide on those types and categories which should be fully catalogued and those which should be brief listed. A realistic policy would create a balance between the two which would enable the available staff to keep up with processing without the creation of backlogs.

At the Processing Decision Point, a processing decision for each item will be made. Tentative processing and routing information may appear on the On Order/In Process File record which can be queried by terminal, or on the workslips accompanying each item; for many items a completely new decision will have to be made, based on the guidelines. A paper strip will be placed in each item to act as a routing slip with the various processing stages stamped on it. The National Library Control Number will identify each item. Additional information will be added to accompanying workslips which will be sent to be keypunched to update the On Order/In Process File. The updated records will show that the material has passed to the Cataloguing Subsystem and the date of the transfer. Printouts of bibliographical data from records on the On Order/In Process File for items about to be catalogued will be produced in the form of Cataloguing Printouts. A Current Receipts Index of Library of Congress Card and Standard Book Numbers, created by the daily update runs against the On Order/In Process File, will be matched against the Union Catalogue where MARC records are stored and MARC Printouts will also be produced for the use of the cataloguers. The item, with Cataloguing and MARC Printouts and its routing strip will now pass to the Cataloguing Subsystem.

A monthly batch process run will search the On Order/In Process File and print out lists of records for items that appear to be delayed in the system, e.g. overdue orders or items that have been in process too long. These monitor reports will also provide management information on the length of time various types of material take to pass through the various stages

of processing, on the delays in filling orders, etc. They will show where bottlenecks are developing and where processing production is unsatisfactory. This will enable management to take appropriate action. These reports will also automatically provide current statistics on the type and number of items received.

The On Order/In Process File will be used as a basis for accounting and fund encumbrancing reports. On-line querying will locate items in process and their status; these queries will be made directly from terminals located throughout the National Library building.

CATALOGUING SUBSYSTEM

This subsystem will comprise all processing and organizing for storage and retrieval of items to be added to the National Library's collection, whether by full cataloguing or by brief listing, and having as the final product a card catalogue, a book catalogue, a machine-readable catalogue or a bibliography. The material for cataloguing will be received from the Acquisitions Subsystem via the Processing Decision Point; each item will contain directions on the type of processing it is to receive and on its final destination and will be accompanied by computer produced printouts giving bibliographical information contained in the On Order/In Process File and in MARC records from the Union Catalogue.

The Cataloguing Subsystem will be a production line. The items will pass from one processing stage to the next and, depending on the type of processing they are to receive, some stages may be bypassed. All the processing work done will be recorded on a Cataloguing Worksheet suitable for all types of material and for both full cataloguing and brief listing; the final product will be a machine-readable record that can be adapted in various ways by the computer to produce cards, book catalogues, machine-readable catalogue entries and bibliographies, including the national bibliography.

Material to be fully catalogued will be pre-searched; then full descriptive cataloguing will be done. If the item is also to be included in Canadiana, additional data elements will be described. The item will then pass to a subject analysis stage where Library of Congress classification will be applied, as well as Dewey Decimal classification and English and French subject headings if the item is to be included in Canadiana. Next the item will be analysed for addition to the Classed Catalogue and its English and French indexes. The Cataloguing Worksheet will now pass to the Reviewing and Coding stage.

Brief listed material will skip the pre-search step and receive brief descriptive cataloguing. The item will then pass through the necessary parts of the subject analysis stage and the completed worksheet will pass to the Reviewing and Coding stage.

In the Reviewing and Coding stage all worksheets will be checked for completeness and accuracy and they will then receive MARC coding and any other codes necessary for machine processing, e.g. Canadiana material will need additional codes for photocomposition. At the end of this stage, the item will be put aside to await labelling and the completed and coded worksheet will be ready for keyboarding.

This study assumes that MTST devices will be used for keyboarding the completed worksheets. These were chosen for speed of input, ease in error correction and ability to handle an extended character set. After keyboarding, a daily batch processing run will produce a proof list which will be checked by a quality control group and errors will be rekeyed and reproof-listed until a correct record is produced. The correct record will then be passed onto a Current Catalogue Records tape which will be used to produce the following current outputs of the Cataloguing Subsystem.

1. Catalogue card production

In a batch process run using the Current Catalogue Records tape, the computer program will select those items which require that standard catalogue cards be produced, will select the relevant fields of each record, format the cards and book labels and will then sort and print the cards and labels. Cards will be produced for main entries, added entries, cross references, authority files and for the Classed Catalogue and its English and French indexes, sorted according to catalogue and ready for filing.

2. Brief list cards and book catalogues

Brief listing may take the form of cards, containing less descriptive bibliographical data than normally required for full cataloguing, or the form of a book catalogue. The computer program to produce brief list cards is very similar to that for producing cards for fully catalogued material. The computer will select from the Current Catalogue Records tape those items requiring brief list cards, select the relevant fields, format the cards, sort them and print them.

The study assumes a book catalogue with a permanent text containing the brief list records arranged sequentially by number and added to by the addition of extra pages containing new records. An index will be cumulated at regular intervals and give multiple approaches in one alphabet. The computer program will select the items to be included in the book catalogue, format them, select and format the index entries, sort the text records, format and print the pages and then sort the index entries, interfile them with previous index entries and print the new cumulated index pages.

3. Canadiana Proof Service and card production

Again using the Current Catalogue Records tape as a base, a batch process program will, each week, select Canadiana items to be included in the Proof Service, select relevant fields, format and sort the records

and produce a tape to go to the Queen's Printer to print the Proof Service cards by photocomposition. Sets of cards (one per record) will then be mailed to subscribers. The same tape can be used to produce card order masters that can be used to reproduce Canadiana catalogue cards on demand. The Current Catalogue Records tape can also be used to produce Canadiana MARC tapes for distribution to subscribers both in Canada and abroad.

4. Publication of Canadiana, monthly issues and annual cumulations

Using the Current Catalogue Records tape as a base for the monthly and the historical Catalogue Records Master tapes for the annual cumulations, a batch processing program will select Canadiana records, select the relevant fields, format the records for the text, select the fields to be used as index approaches, select the fields needed for each index entry and format the index entries. The program will then sort the text and the index. A proof listing of the text and the index will be produced and verified by Canadiana editorial staff. Errors will be rekeyed and re-prooflisted. When an error-free text and index tape is produced, it will be run through a program to edit it for printing and this will result in a tape which will be sent to the Queen's Printer for publication of Canadiana by photocomposition. Thus in this integrated Cataloguing Subsystem, Canadiana will be a by-product of the basic cataloguing process, produced by a reprocessing of the basic catalogue record in machine-readable form.

5. Other uses of the basic catalogue records

After all the required outputs (cards, book catalogues, Canadiana, etc.) have been produced from the Current Catalogue Records tape, the tape will then be passed against the three National Library on-line files: against the On Order/In Process File to remove from that file all records for items that are now fully processed and appear in the National Library Catalogues; against the Serials File to update temporary entries and

add cataloguing information to the records; against the Union Catalogue to add to it the National Library's own holdings. The Current Catalogue Records will now be transferred to a permanent historical Catalogue Records Master tape file. This master file can be used, as required, to select and print out bibliographies and classed catalogues of portions of the National Library collection, or to produce selective Canadiana printouts, by the use of a parametrically fed search program.

SERIALS CONTROL SUBSYSTEM

The Serials Control Subsystem will be concerned with the creation and maintenance of a serials record file against which incoming issues of serials may be checked and which will produce various lists of serials holdings as well as immediate information on the receipt of a serial issue by the Library. Serials will be acquired and claimed by the Acquisitions Subsystem and catalogued by the Cataloguing Subsystem. Public service and reference work with serials will be possible by querying the Serials File on-line and by use of the various lists produced by the Serials Control Subsystem.

The Serials Control Subsystem is based on an on-line Serials File on disk which can be queried by terminals located at various points throughout the National Library. The File will contain records for all types of serials, both current and retrospective. Batch processes will create, maintain and update the File and print out various lists.

A record for a serial will be created at the time it is ordered, or in the case of deposits, gifts and exchanges, at the time the first issue is received by the Library, when a temporary entry will be made, keypunched and batch added to the Serials File. When a serial has been catalogued, the temporary entry on the Serials File will be changed and updated by processing the Current Catalogue Records tape against the File. The Serials File will be updated daily so the latest holdings of the National

Library will be readily ascertainable by terminal query in real time.

Two lists will be produced from the Serials File, the Serials Title List, weekly, and the Serials Holdings List, monthly. The Serials Title list, in alphabetical order by main entry, will be used to find the record number for serials check-in and to find shelf locations. It will not contain holdings. It will be produced in multiple copies which will be located at various points throughout the Library. The Serials Holdings List will contain holdings, shelf locations and bibliographical data. It will be used by reference staff and library patrons to locate and obtain issues of serials as required. It will also be checked for errors and for missing issues which should be claimed. Errors will be corrected and claims flagged by use of an on-line terminal. In addition, the computer will also be programmed to search for and print lists of claims. The checking of the Serials Holdings List will note claims for those irregular and complicated serials that the computer program cannot catch.

The check-in of current serial issues and of retrospective issues to fill gaps in the collection will be performed on-line at a CRT terminal. The issues received each day will first be sorted into alphabetical order and checked against the Serials Title List to find the National Library Control Number which will then be written on the issue together with the shelf location. The issues will then go to terminal operators who will key in the National Library Control Number written on the serial. The record for that serial will now be visually displayed on the screen and the operator will key in, directly from the serial issue before him, the volume number and date of the new issue. This will immediately be displayed for visual verification. Routing information can be noted from the displayed record and the issue will then be sent to its destination. This on-line serials check-in method obviates the use of an intermediary worksheet with its double copying of new issue information.

The Serials File will be compatible with the format used to produce union lists and it will be used to produce the National Library's input to various union lists of serials and newspapers as well as to provide on demand, by searches fed parametrically, data about the serials collection of the National Library and various lists and bibliographies.

A terminal at the location where unpacking and sorting of serials received from other libraries takes place will allow National Library duplicates to be identified immediately; issues required to fill gaps in the National Library collection can be added to the record holdings by terminal and routed to the shelf destination indicated in the record.

UNION CATALOGUE SUBSYSTEM

The Union Catalogue, the largest file in the National Library, will be an on-line file stored on a massive direct access storage device. This study assumes the use of large scale magnetic disk files. Records, one per title, will give locations of all the libraries holding that title. Indexes to the Union Catalogue will be stored on smaller faster disks and there will be three indexes which will refer directly to the address of the record: a Library of Congress Card Number index, a Standard Book Number index and an author/title index. The first two indexes will be used for quick matching of records, so it will be essential that all accessions to the Catalogue contain these numbers when they exist. The author/title index will be based on a word compression technique similar to that described in the RECON Study[1] and in various articles by Frederick H. Ruecking. Before a detailed system for indexing and searching the Union Catalogue is finalized, a great deal of research needs to be done to test and evaluate various possible methods. The National Library will be breaking new ground here in retrieval from a large on-line bibliographical data bank.

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1. Library of Congress. Conversion of retrospective catalog records to machine-readable form; a study of the feasibility of a national bibliographic service, prepared by the RECON Working Task Force. Washington, 1969. p. 199-210.

The present manual Union Catalogue provides a location service only. The Canadian research library community has indicated that broader services would be required from an automated Union Catalogue which should be a full bibliographical data bank capable of fulfilling all bibliographic and processing needs. A policy decision will have to be made on the services to be provided from an automated Union Catalogue, considered in relation to the needs of Canadian research libraries, to cooperation with international library networks and to the costs of various alternative solutions and their ensuing benefits.

The system proposed will develop an automated Union Catalogue, constructing a data base by collecting all the machine-readable records available, MARC tapes and tapes from the RECON project now being undertaken by the Library of Congress, as well as tapes from selected Canadian and possibly American university libraries which have converted their catalogues to machine-readable form. It is estimated that by 1973-74 sufficient tapes will be available to form a data base to which current Union Catalogue accessions could be added. At this point the manual Union Catalogue will become a dead file and no further accessions will be added to it. By 1974-75, the data base of retrospective material will be sufficiently built up so that the old manual Union Catalogue records can be matched against it and locations added for matched records. This method of converting the present manual Union Catalogue, by matching against a data base of retrospective and current material, obviates the need to edit and convert the manual catalogue. Only a small residue of records will not match and will have to be edited and keyboarded.

The data base resulting from this method can be used for a location service or for a full bibliographical data bank depending on the number

of bibliographical elements contained in each Union Catalogue record. The highest cost connected with the Union Catalogue is for on-line machine storage, so the size of the records is the critical factor.

The minimum service that would be provided by an automated Union Catalogue would be a location service as at present, but a more efficient one, with quicker response time. The minimum requirement for bibliographical elements necessary to a location service, with additional facilities for producing management information on Canadian library collections, has been studied. Records would have an average length of 314 characters. The automated location service would have one edited record per title containing all holdings, facility for retrieval by multiple approaches and for provision of management data on Canadian book collections sufficient for use in the rationalization of Canadian acquisitions policies. Breakdowns of Canadian collections by various criteria could be produced by a parametrically fed search program, as well as selected printouts of holdings by subject, university, etc. However, this type of catalogue would not provide the full bibliographical information necessary for the production of conventional catalogue cards.

The maximum service which could be provided by an automated Union Catalogue would be that of a full bibliographical data bank. This would contain records of a detail at the level of the full MARC record, an average of 500 characters each, with, in addition, holdings of Canadian libraries. This type of catalogue could provide all the services described in the preceeding paragraph, as well as sufficient detail for any bibliographical use, for example the production of catalogue cards.

Between these two possible types of Union Catalogue there are many intermediate possibilities which would provide more bibliographical information than that required for a basic location service, but not as

much data as in a complete MARC record. It would also be feasible to have a mixture in the amount of detail in the records included in the Catalogue. To make possible an automated Union Catalogue, it will be necessary to insist that a certain degree of standardization be observed in accessions and also in the submission of inquiries to the Catalogue. The determination of a policy on Union Catalogue services and of agreements on standards are considered by this study to be of the utmost urgency.

Regardless of the degree of service to be provided by the Union Catalogue, i.e. strictly location or full bibliographical service, and regardless of the amount of detail to be provided in each record, the basic operation of the proposed system will remain the same. The Union Catalogue Subsystem is a combination of batch and on-line processing. There are three main parts of the system: the matching and addition of accessions to the catalogue; the editing of non-matched accessions and their addition to the catalogue; and the answering of inquiries to the catalogue.

1. Matching and addition of accessions

Accessions will be received from libraries in printed form, as at present, and in machine-readable form.

Accessions to the Union Catalogue received in machine-readable form will receive off-line batch processing. First the tapes will be run through a translate and conversion program to translate codes into the machine codes used by the National Library and to convert the record format (MARC) into the Union Catalogue's own internal storage format. A second batch program will match the accessions against the Union Catalogue file, first trying to match records by Library of Congress and Standard Book Number, and, failing this, by author and title and other bibliographical elements sufficient to assure a valid match. Matched accessions will have their location added to the existing record. Unmatched accessions will be printed out for editing.

Accessions to the Catalogue received in print format will be matched with the Union Catalogue on-line. An operator at a CRT terminal will first try to match by Library of Congress or Standard Book Number, failing this, by author, title and other bibliographical elements. If a match is indicated, the record will be displayed for visual verification and comparison with the accession. New locations will be added to valid matches. Unmatched records will be set aside for editing. This same method will be used for conversion of the retrospective manual Union Catalogue.

The CRT terminal was chosen for this application because it can display full records faster than they can be automatically typed by a typewriter-type terminal. The on-line method of matching printed accessions was chosen because it drastically reduces the required number of keystrokes; only the bare minimum of data needed to establish a match need be keyed and it is estimated that in 90% of the cases, Library of Congress Card or Standard Book Numbers will be available. A batch process would require the typing of the entire accession in order to match it off-line.

2. Editing and processing of non-matched accessions

Unmatched accessions, either printouts of machine-readable accessions or unmatched cards or slips, will be edited and coded if necessary (printouts will already have MARC coding). The completed worksheets will then be keyboarded using a MTST device. A batch process run will format and proof list the records. The prooflist will be verified and errors corrected. The verified records tape will then be batch processed against the Union Catalogue and the records added; necessary index entries will be created and stored.

MARC records will be stored in the Union Catalogue weekly, as they are received from the Library of Congress and other sources. This procedure will create records in the Catalogue against which in-coming accessions can be matched and thus will considerably reduce the number of non-matches

that will have to be edited and processed. These MARC records will also be available for the use of the Cataloguing Subsystem; printouts of records for new National Library acquisitions will accompany the items to cataloguing.

3. Union Catalogue inquiries

Inquiries to the Union Catalogue are received by telephone, mail, in person and by telex and TWX. The proposed system will also permit outside libraries having terminals on-line to the Union Catalogue to search the catalogue by telecommunication lines without the intervention of National Library personnel.

Inquiries received by telex or TWX will be directly handled by the computer. They will be received and stored temporarily on disk until the central processor is free to handle them. Then each inquiry will be translated to Union Catalogue codes, formatted and a search code constructed; the file will then be searched by computer. If the answer is found, it will be transmitted directly back to the inquiring library without manual intervention. Unanswered inquiries will be printed out for human-aided search.

Other inquiries will be searched on-line using CRT terminals. The operator will key in a minimum of data to set up a search code. The search will be conversational with the computer displaying records, indicating the number of records which appear to answer the inquiry, permitting browsing through selected records and asking for additional data elements to narrow the search. This method keeps the keying of data to a minimum and takes advantage of the ability of the human operator to manipulate data and to try different spellings, forms of names and different approaches, etc., in setting up a search. Locations found will be noted for transmission to the inquirer by telephone, mail, telex or TWX, in the same way as they were received. If more detailed information than locations is required, such as copies of records, these will be printed out by the computer at

intervals during the day.

In addition to the management type of information on Canadian collections and on the make-up of the Catalogue discussed above, the Union Catalogue will be able, by using a parametrically fed search program, to produce catalogue cards, tapes of selected machine-readable catalogue entries, bibliographies, etc.; the flexibility of the file will permit its use as a bibliographical tool in a multitude of ways.

UNION LISTS SUBSYSTEM

The National Library has a responsibility for the production and publication of various union lists, especially a union list of serials in the social sciences and the humanities to complement the Union list of scientific serials produced by the National Science Library. The two lists should be completely compatible.

At present, data on serials is received by the National Library from Canadian libraries and filed in a manual file, the Union Catalogue of Serials, a supplement to the Union Catalogue. This is used to answer location inquiries for serials on all subjects. The National Library should also prepare and maintain union lists of Canadian and foreign newspapers held by Canadian libraries.

Although some preliminary lists of currently received titles have been produced for both serials and newspapers, the basic volumes giving complete holding information for Canadian research libraries remain to be compiled and published. The records should be stored in machine-readable form so that additions to the records can be made easily as they are received and so that supplements to and new editions of the union lists can be published at suitable intervals.

The system for collecting data, editing it and publishing union lists is basically the same whether the list is for serials or newspapers, therefore only the proposed system for the Union List of Serials is

described.

Preparation of the basic union list file

A great deal of basic data on Canadian serial holdings has already been collected by the National Library and is being added to daily. This data must be edited and converted to machine format. A format for serials will have to be devised which is compatible with the format used by the National Science Library's Union List and with the MARC format for serials now issued in preliminary edition by the Library of Congress.

Serials holdings will be received from some libraries in machine-readable form. Tapes received from libraries will be run through a translate program to convert them to National Library machine codes, records will be formatted, sorted and the various types merged so that all records for the same serial are together. These merged records will now be printed out and will be manually matched with records from the Union Catalogue of Serials. Each record will be edited, coded and assigned a control number. Completed worksheets for the records can now be keyboarded, batch processed, formatted, sorted and a prooflist printed for manual verification by union list editors. Errors will be corrected and verified records written on the Union list of Serials Master tape.

Union list master file update

Since Canadian libraries are constantly receiving new serial titles and adding to the holdings of the serials they already receive, the Master File should be constantly updated. Updates received in machine-readable form will be sorted and matched against the Master File in a batch process. If a record is already on the Master File, the new locations and holdings will be automatically added to the record and an updated master tape produced. New serials titles which cannot be matched to the Master File will be printed out for manual editing and coding.

Updates received in print format will be compared with the latest printed union list, its supplements and interim prooflists. If the serial

is already on the list, only the control number, new locations and holdings will need to be keyboarded. New titles not on the list will be edited, coded, keyboarded, batch processed and proof listed. Errors will be corrected and verified records will be added to the Master File.

Publication of lists and supplements

The basic list, new editions and interim supplements will be produced using the Master File, updated to a certain cut-off date. This file will be batch processed, either, in the case of supplements to format, sort and proof list all the records which have been added or changed since the previous edition or supplement, or, in the case of a basic list or new edition, to format, sort and proof list all the records. If it is considered desirable when a new edition of a list is prepared, proof lists of the holdings of individual libraries can be produced and sent to them for verification. Proof lists will be verified by union list editors, and corrections made. The resulting Union List tape will be run through a batch program to edit it for photocomposition. The photocomposition tape will be sent to the Queen's Printer for publication of the union list.

The Union List Master File can be used with a generalized search program to print out selected bibliographies of serials, by subject, holding library, country of origin, language, holdings of geographical regions of Canada, etc., as required.

SUBSYSTEMS EXCLUDED FROM DETAILED ANALYSIS

Reference and Public Service

With the exception of the answering of inquiries to the Union Catalogue, most reference and public service activities of the National Library, concerned with answering questions, locating material, assisting in research and directly serving library clientele, are not included in the proposed automated information system. These services depend on research by individual reference staff and on personal contact with

library users, thus they do not directly fit into the information flow of the automated system, however, the system does provide all the essential bibliographical tools necessary to reference personnel in carrying out their work: card and book catalogues, union lists, the national bibliography and machine-readable on-line catalogues. The latter can be queried by National Library staff or by the public. The automated information system through its generalized search program which can be fed parametrically, provides the facility of producing bibliographies and statistical and other information on demand. This should save much time and effort now spent in searching files manually. In brief, the proposed system provides all the bibliographical data needed for reference service, with better and quicker access, but it does not control or systematize the procedures or information flow of reference activities. Thus, this study has excluded from detailed analysis the actual procedures and processes used by reference personnel in performing their work. It is probable that changes in procedures and processes may be desirable on implementation of the proposed system and a study should be made of references services in the light of these proposed changes.

Circulation and Interlibrary Loans

National Library circulation and interlibrary loan activities will continue to be manual systems, as the volume of requests handled, the records maintained and the expenditure necessary to perform the work are not yet great enough to warrant automation. The work can be successfully performed by a small clerical staff, at minimum expense. However, it should be noted that these activities could easily be converted to an automated system at a later date when volumes and costs warrant it.

Canadian Theses services

Canadian Theses on Microfilm

This study considers that the processing of theses received from universities for microfilming and the filling of orders for microfilmed theses can efficiently continue as a manual operation. The cataloguing of Canadian Theses on Microfilm will be done as part of the proposed Cataloguing Subsystem; basic machine-readable records will be produced from which cards for the National Library Catalogues and digital copy for inclusion in Canadiana will be processed. It would be a simple matter to update the Canadian Theses on Microfilm Price List using these machine-readable records. If the retrospective records presently contained on the price list were converted to machine-readable form, a complete price list could be produced and arranged or indexed by author, title, subject or university as desired. Individual lists of theses by various criteria could be produced on demand.

Canadian Theses list and research in progress

Since the theses listed in the annual publication, Canadian Theses are not necessarily acquired by the National Library and published on microfilm, but only a subset of them are selected and sent to the National Library for microfilming, the theses will not all be contained on the Cataloguing Records Master file or appear in National Library Catalogues.

Considering the volumes involved, it is quite feasible to continue to produce the annual list manually for publication. However, an automated system for publishing the list would allow easy cumulation of the annual lists at intervals and would facilitate the provision of multiple approaches to the theses by an index produced automatically from the records. In addition, if the records were available in machine-readable form, individual printouts by subject, university, etc., could be produced on demand.

There is a need also for a Canadian data bank on research in progress. Machine-readable records for theses in progress and theses accepted by Canadian universities but unpublished could be combined with other reports on research in progress to form this data bank. This possibility should be examined after the proposed system has been implemented.

BENEFITS OF THE PROPOSED SYSTEM, ITS FUTURE APPLICATIONS AND INTERFACE WITH OTHER LIBRARIES

The concept of modularity

The proposed system is a modular one based on the production of a basic machine-readable record which is used to produce all the outputs and requirements of the National Library staff and of users in outside libraries. The basic catalogue record is comparable with the MARC format and can be used as input to National Library catalogues, to the national bibliography, to the union catalogue automated bibliographic data bank and to union lists.

All the machine-readable files of the proposed system will be compatible and can be used to produce bibliographies, lists and management and statistical information by the use of a gneeralized search program fed parametrically.

Programs will be developed modularly and will employ a great many common subroutines. While the implementation programme should consider the system as a whole, it can be developed incrementally and added to gradually.

Future applications

The proposed information system lends itself to future applications which can be added to the existing system as time, money and new requirements dictate. A good example of this flexibility is shown in the Union Catalogue Subsystem. Development of this could begin in a small way as an automated location service and could be expanded to a full bibliographic data bank

with multiple services; new services would be added gradually. Records which would be stored on-line, at first would have an average of 314 characters; they could be expanded from off-line tape files to full bibliographical records of an average of 500 characters each. A full data bank could gradually provide the following services: subscriptions to selected machine-readable cataloguing copy chosen from MARC tapes from various countries; a shared cataloguing programme for Canada; the maintenance of on order and circulation status records as well as holding information for contributing libraries; automatic interlibrary loans by direct routing of requests to the nearest library having a copy of the required item which is currently not in use; production of regional catalogues from the central data bank; automatic production of catalogues for new libraries and of replacement catalogues for existing libraries.

Future applications which could be added to the proposed system could be: an automated circulation system for the National Library; an automated in process system for Canadiana deposits and gifts; an on-line National Library catalogue; publication of various National Library catalogues and authority files; use of on-line cataloguer terminals by which each cataloguer could search catalogues and authority files and directly enter data for new records; automation of Canadian theses and research in progress information as described above; addition of new indexes for better retrieval from on-line files as new standardized approaches become general, for example, the use of Standard Serial Numbers to access the Serials File. The flexibility and adaptability of the proposed system thus lends itself to other applications and to interfaces with other libraries.

Interface with other libraries

The proposed National Library system provides basic data for the provision of bibliographic services to the Canadian library community.

The basic bibliographic service now provided by Canadiana, the national bibliography, will continue; a speed up in publication by the automatic preparation of Canadiana photocomposition copy from the basic machine-readable catalogue record is expected. A weekly proof service, either on cards or on MARC tapes, will be available to all who wish to subscribe, as well as a catalogue card service. These will provide bibliographic data on Canadian publications for worldwide distribution.

If a decision for a full bibliographic data bank Union Catalogue is made, it will provide a cataloguing copy service and act as a national distribution centre for MARC records from all countries and will provide a base on which to build a Canadian shared cataloguing project. The automated Union Catalogue will provide a more up-to-date location service as well as data on Canadian library collections which can be used in the rationalization of Canadian library acquisitions policies. Union lists will provide a similar service for serials and newspapers.

Canadian library network

The bibliographic data bank formed by the Union Catalogue can become the basis of a Canadian bibliographic data network. A network system may be centralized or decentralized, depending on such factors as the number of users and their geographical dispersion, the size of the data base and the resources available to maintain it.

Possible nodes for a Canadian bibliographical data network might be national, regional, provincial and local. The duplication of the data base at these various nodes is a very costly consideration and it may not be economically feasible to duplicate the Union Catalogue and store it on-line at a number of locations with the resources available in Canada to support such a network. One solution would be duplication of only parts or subsets of the catalogue divided by subject, language, etc.

Geographic dispersion is a problem for a Canadian network. Long distance transmission charges are high, although it is hoped that microwave facilities and the use of a communications satellite may make new methods of charging possible in the near future.

Experience with using an on-line bibliographic data network will be necessary to demonstrate all the implications and problems. It is recommended that the Union Catalogue be developed as a data base for a Canadian bibliographical network and that, at the beginning, the network consist of two nodes only, national (the National Library) and local. International links to bibliographic data banks in other countries, for example, to the Library of Congress, can be joined from the national network center in Ottawa.

Standardization

A bibliographical data bank network, use of cataloguing from many countries and the use and collection of cataloguing data from the Canadian library community for the Union Catalogue and for union lists requires a certain amount of standardization. The present Union Catalogue has long been in difficulties owing to a lack of standardization. The National Library should require that a certain basic number of data elements be provided to constitute an acceptable accession to either the Union Catalogue or to union lists. Accessions and requests not meeting a minimum standard should be rejected.

It will be essential for the National Library to exchange machine-readable bibliographic data with other libraries in the MARC II format,

thus libraries will have to use formats that they can convert to the MARC format for sending data to the National Library. It should be pointed out, that although it may be permissable to omit some of the less improtant data elements included in the MARC format, it is absolutely essential that the content designators used for the data elements that are included should be those of the format and that they should not be simplified or abbreviated in any way, as processing has to be done at the lowest common denominator of content designators provided.

SUMMARY OF BENEFITS TO BE DERIVED FROM THE PROPOSED SYSTEM

General

1. A parametrically fed search and report program will permit selected lists and bibliographies to be produced from all machine-readable files, on demand, as well as statistical and other management reports.

2. Terminals in strategic points throughout the National Library building and in outside libraries will permit on the spot querying of on-line files.

3. The system is modular and will lend itself to future expansion and new applications.

4. The system provides an integrated flow of information throughout all segments of National Library operations.

5. The system will provide faster processing and improve the response time of basic routines and internal housekeeping operations.

6. The system will provide more accurate and up-to-date performance and library operating data to management.

7. The system will provide full bibliographic control over internal technical processing for the National Library's traditional functions: acquisitions, cataloguing and serials control.

8. Terminals located at points where the unpacking of material received from other libraries is done, will allow items to be immediately checked against the National Library's holdings for duplication.

9. The system will provide a data base for the development of a Canadian library network.

Acquisitions

1. Bibliographic data is captured in machine-readable form at the point of origin and passed on to processing, thus valid data will not require to be constantly rekeyed and additions, changes and deletions can be made as required.

2. Items in process will be constantly monitored so that material cannot be overlooked or held up indefinitely in any one processing phase.

3. Claims will be automatically produced.

4. Statistics, accounting and fund encumbrancing information will be collected and made available.

5. The On Order/In Process File can be queried by terminal in real-time from various points in the Library.

Cataloguing

1. One basic machine-readable record will be made for all types of material and will be stored permanently in historic tape files. This basic record can produce all the processing needs of the National Library: catalogue cards, book labels, book catalogues, photocomposition copy for the Canadiana proof service, the Canadiana card order service and the printing of Canadiana. It will also permit easy cumulation of Canadiana and other book catalogues. The basic record will provide input to machine files such as the Union Catalogue and the Serials File. Historic files can produce selective Canadiana printouts, book cards for a future circulation system and the publication of authority files and indexes. Canadiana MARC tapes will be produced from the basic records.

2. All bibliographic data present in the National Library files, Union Catalogue, MARC tapes, On Order/In Process File, will be printed out in the form of worksheets for the use of the cataloguers, thus saving duplicate effort in searching for and preparing bibliographic data and making possible the use of externally produced cataloguing data.

3. The present constant typing backlog of catalogue cards will be overcome, as cards will be typed automatically by on-line printer.

4. The processing of all types and forms of material, e.g. monographs, serials, government documents, etc., will be done by the Cataloguing Subsystem, using a standard worksheet, a standard machine format and standard processing methods. Reference personnel will be freed from processing duties to concentrate on service to clientele.

5. A manual catalogue will be provided for the use of staff and patrons, but the National Library's holdings will also be available in machine-readable form in the Union Catalogue.

Serials Control

1. One on-line machine file will be provided for the recording of all serials regardless of their origin; thus government document serials will be included in the file with other serials, but a separate printout for them can be provided if desired.

2. The Serials File will automatically provide National Library input to union lists.

3. The Serials File can be queried on-line and the input is performed on-line directly from the serials issues so that there is no extra copying of data and thus less danger of error. Corrections to the file can also be made on-line.

4. A terminal in the unpacking area will allow duplicate serials received from outside libraries to be checked against the National Library holdings and, if wanted, checked in on the spot.

5. The Serials File can be queried by terminal in real-time from various points in the Library to get information on the latest issue received. The monthly and weekly lists of serial titles and serial holdings will be available at various points in the Library, will make information available on the spot and will obviate the need for constant telephoning now necessary to query the Kardex.

Union Catalogue

1. Editing and massive keyboarding for conversion of the old card Union Catalogue will be largely avoided and reduced to a minimum.

2. Accessions will be completely current.

3. Management information needed for the rationalization of Canadian research library collections and acquisitions policies can be provided.

4. Libraries can be directly on-line and do their own querying of the catalogue.

5. The system is modular; expansion to a full bibliographical data bank with all its many services to the Canadian library community is possible.

6. The procedures for the addition of accessions and the answering of inquiries permit a man-machine interface which combines human knowledge and skill in the manipulation of bibliographical data with the speed of computer searching.

7. Bibliographical records can be located from multiple approaches.

Union Lists

1. The publication of union lists with complete holdings of Canadian libraries and the maintenance of an up-to-date master file will facilitate interlibrary loans of serials throughout the country.

2. The union lists will assist in the rationalization of Canadian library collections by showing which titles are held by various libraries and in various geographical regions.

3. Automation of the union list files will provide ease in updating and in publication of new editions and supplements.

PART III. COST ANALYSIS

Hardware

To estimate the computer processing requirements, principal data processing runs were identified, a set of average computer characteristics was chosen and timing calculations for the batch runs were made, based on the logic of the runs and the volumes of data processed. The results of the timing calculations show a total batch processing requirement of approximately 100 hours per month. Besides the batch capacity, however, the computer must have the capacity to process inquiries from remote terminals in real-time. Such inquiries would be given processing priority and hence will increase the effective time required for batch processing. The amount of this degradation will initially be small, less than 10%, but when the Union Catalogue is phased into the system, the resulting increase in inquiries could degrade the system performance to the extent that second shift operations might be required.

The likely computer configuration is as follows: a central processing unit with 132 K memory, a minimum of four magnetic tape drives, fast disk storage to house large files and the main data base, a high speed printer with an upper/lower case library print chain, a card reader, a card punch and control units to interface with remote terminals. This equipment would rent for approximately $1,700 per month for the basic system, but additional storage would be required for the Union Catalogue.

The cost of the proposed system is calculated here according to the likely implementation and operation timetable indicated in Figure 5 in the next part of this summary. For cost calculation purposes, the alternative of the creation of an automated Union Catalogue by means of a data base has been chosen. Table 2 presents

the total cost of the hardware from 1972 to 1980.

Staff

The transformation of the manual information processing of the National Library into a fully integrated automated system implies changes in the personnel of the institution. The development and operation of the proposed system will require new types of personnel with unique skills and qualifications - programmers, systems analysts and processing managers. The existing personnel of the National Library will also be involved and will require training in the new system.

The basic organization necessary to implement and operate the proposed system is shown in Figure 2. Five classes of personnel will be required: clerical staff, operating staff, programmers, systems analysts and management personnel. The staff costs of the proposed system are summarized in Table 3. Salary figures were based on the likely salary level and costs were increased 6% per year based on 1969-70 salary scales.

Cost comparison

An overall cost comparison of the present and the proposed systems are shown in Table 4 and Figures 3 and 4. For this overall cost comparison, Alternative I of the Union Catalogue (the continuation of the present manual system without change) has been chosen for the costing of the manual system. In this case, the savings of the new proposed system from 1971 to 1980 over the present manual system are approximately $750,000. When Alternative II (an improved manual system) is chosen for the costing of the manual system in order to compare the two systems on an equal basis, the savings of the new proposed system over the manual system from 1971 to 1980 are over $2 million; not counting all the other advantages of automation.

TABLE 2 : HARDWARE COST FOR FULLY INTEGRATED SYSTEM

FISCAL YEAR	1972-73		1973-74		1974-75		1975-76		1976-77		1977-78		1978-79		1979-80	
DESCRIPTION	QTY	$	QTY	$	QTY	$	QTY	$	QTY	$	QTY	$	QTY	$	QTY	$
BASIC COMPUTER CONFIGURATION		18,000		18,000		18,000		18,000		18,000		18,000		18,000		18,000
EXTRA FAST DISKS	1	6,517	1	6,517	1	6,517	1	6,517	1	6,517	1	6,517	2	13,034	2	13,034
EXTRA SLOW DISKS	2	19,540	3	29,310	3	29,310	3	29,310	3	29,310	3	29,310	4	39,080	4	39,080
CRT TERMINALS	2	240	13	1,560	13	1,560	16	1,920	17	2,040	17	2,040	18	2,160	17	2,040
KEYTAPES (MTST)	6	1,080	9	1,620	10	1,800	11	1,980	11	1,980	13	2,340	14	2,520	14	2,520
KEY PUNCHES	3	240	4	320	5	400	5	400	6	480	6	480	6	480	7	560
TOTAL MONTHLY COST		45,617		57,327		57,587		58,127		58,327		58,687		75,274		75,234
TOTAL YEARLY COST		410,553 (1)		687,924		691,044		697,524		699,924		704,244		903,288		902,808

(1) Costed for 9 months only because the machines will be installed in July 1972.

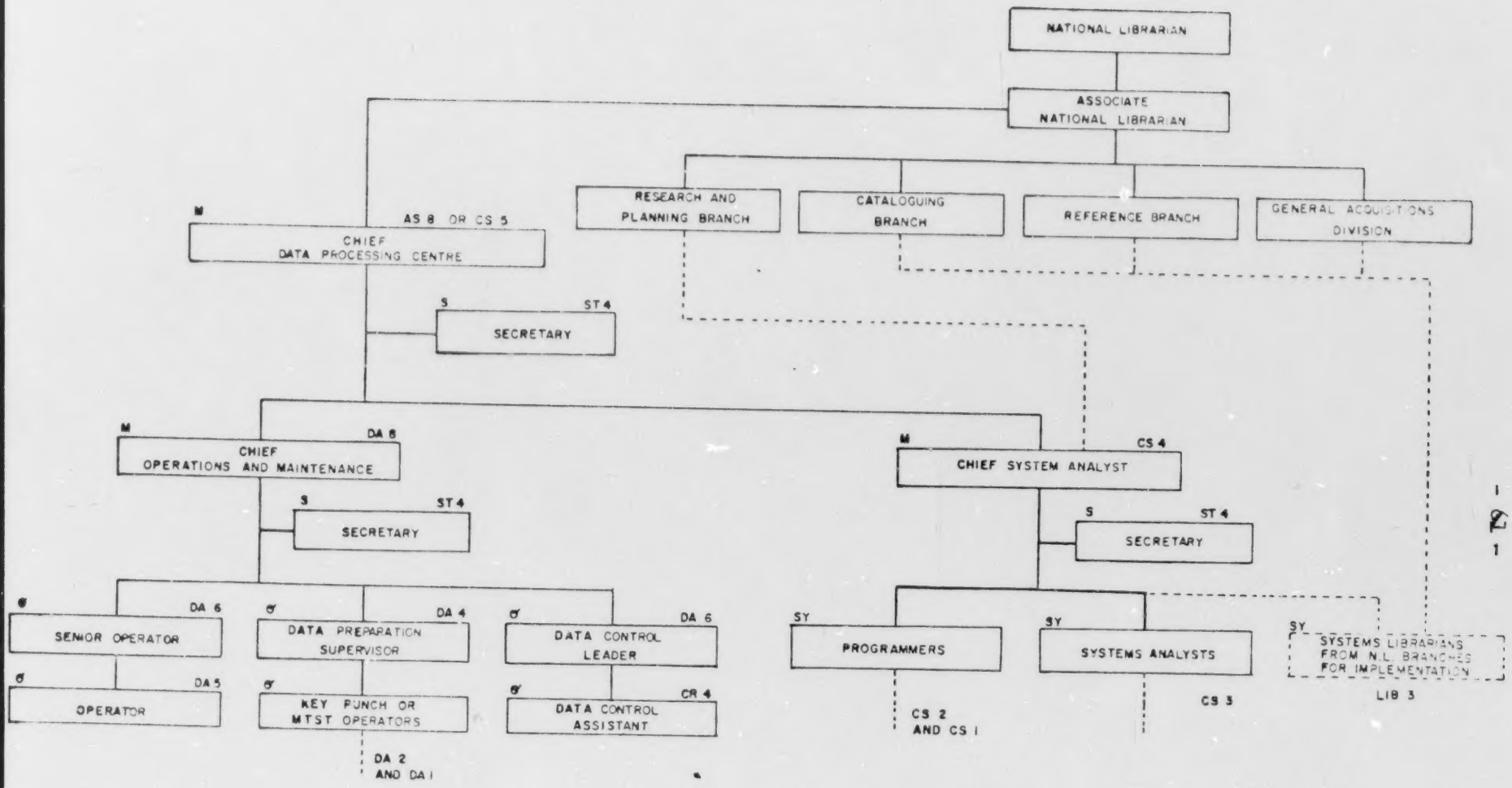


FIGURE 2: NATIONAL LIBRARY INFORMATION SYSTEM - STAFF REQUIREMENTS

STAFF FUNCTION CODE
- M: MANAGEMENT
- SY: SYSTEMS
- ♂: OPERATION
- S: SUPPORT

TABLE 3: STAFF COST FOR MANAGEMENT, SYSTEMS ANALYSIS, SECRETARIAL WORK, COMPUTER OPERATION, DATA CONTROL AND PROGRAM MAINTENANCE AT THE DATA PROCESSING CENTRE (1)

FISCAL YEAR	JOB DESCRIPTION	POSITION	MAN-YEARS FOR THAT YEAR	YEARLY SALARY $	TOTAL SALARIES $	FRINGE BENEFITS 15% AND OVERHEAD 20% TOTAL 35% $	TOTAL YEARLY COST $
1971-72	Management	CS5 (2)	1	22,472	22,472		
		CS4	1	17,978	17,978		
	Systems Analysis	CS3	4	15,730	62,920		
		LIB3	3	10,674	32,022		
	Secretarial Work	ST4	2	6,180	12,360		
					147,752	51,713	199,465
1972-73	Management	CS5	1	23,820	23,820		
		CS4	1	19,057	19,057		
		DA8	1	13,339	13,339		
		DA4	1	7,980	7,980		
	Systems Analysis	CS3	3	16,674	50,022		
		LIB3	3	11,314	33,942		
	Secretarial Work	ST4	3	6,551	19,653		
	Computer Operation	DA6	1	9,051	9,051		
		DA5	1	8,337	8,337		
	Data Control	DA6	1	9,051	9,051		
		CR4	1	7,851	7,851		
	Program Maintenance	CS3	½	16,674	8,337		
		CS2	½	12,360	6,180		
					216,630	75,820	292,450
1973-74	Management	CS5	1	25,249	25,249		
		CS4	1	20,200	20,200		
		DA8	1	14,139	14,139		
		DA4	1	8,459	8,459		
	Secretarial Work	ST4	3	6,944	20,832		
	Computer Operation	DA6	1	9,594	9,594		
		DA5	1	8,837	8,837		
	Data Control	DA6	1	9,594	9,594		
		CR4	1	8,333	8,333		
	Program Maintenance	CS3	2	17,674	35,348		
		CS2	2	13,102	26,204		
					186,789	65,376	252,165

TABLE 3, CONT'D

FISCAL YEAR	JOB DESCRIPTION	POSITION	MAN-YEARS FOR THAT YEAR	YEARLY SALARY $	TOTAL SALARIES $	FRINGE BENEFITS 15% AND OVERHEAD 20% TOTAL 35% $	TOTAL YEARLY COST $
1974-75	MANAGEMENT	CS5	1	26,764	26,764		
		CS4	1	21,412	21,412		
		DA8	1	14,987	14,987		
		DA4	1	8,966	8,966		
	SECRETARIAL WORK	ST4	3	7,361	22,083		
	COMPUTER OPERATION	DA6	1	10,170	10,170		
		DA5	1	9,367	9,367		
	DATA CONTROL	DA6	1	10,170	10,170		
		CR4	1	8,833	8,833		
	PROGRAM MAINTENANCE	CS3	3	18,734	56,202		
		CS2	3	13,888	41,664		
TOTAL					230,618	80,716	311,334
1975-76 TOTAL	SAME REQUIREMENTS AS IN 1974-75; TOTAL SALARIES ARE INCREASED 6% PER YEAR.				244,455	85,559	330,014
1976-77 TOTAL					259,122	90,693	349,815
1977-78 TOTAL					274,669	96,134	370,803
1978-79 TOTAL					291,149	101,902	393,051
1979-80 TOTAL					308,618	108,016	416,634

1. These costs have not been shown in the costing of each module in Appendix G. Only the staff costs of keyboarding, coding, proofreading and initial programming has been costed with each module in that Appendix.

2. This position could be an AS8 as well.

TABLE 4: OVERALL COST COMPARISON OF PRESENT AND PROPOSED SYSTEM*

FISCAL YEAR	PRESENT SYSTEM		NEW PROPOSED SYSTEM	
	YEARLY COST $	CUMULATED COST $	YEARLY COST $	CUMULATED COST $
1971-72	1,287,485	1,287,485	1,714,258	1,714,258
1972-73	1,538,541	2,826,026	2,288,097	4,002,355
1973-74	1,833,473	4,659,499	2,165,835	6,168,190
1974-75	2,052,321	6,711,820	2,120,906	8,289,096
1975-76	2,283,641	8,995,461	2,015,113	10,304,209
1976-77	2,515,020	11,510,481	2,079,108	12,383,317
1977-78	2,769,846	14,280,327	2,232,345	14,615,662
1978-79	3,050,497	17,330,824	2,285,123	17,200,785
1979-80	3,359,592	20,690,416	2,740,339	19,941,124
SEE	FIGURE 11	FIGURE 12	FIGURE 11	FIGURE 12

* It should be remembered here that Alternative I of the Union Catalogue has been chosen for the costing of the manual system. If Alternative II (an improved manual system) were chosen, the savings with the new proposed information system of the National Library would be much greater. Instead of saving $749,292 with the proposed system from 1971 to 1980, the real savings are $1,252,373 + $749,292 = $2,001,665; not counting all the other advantages of automation.

FIGURE 3

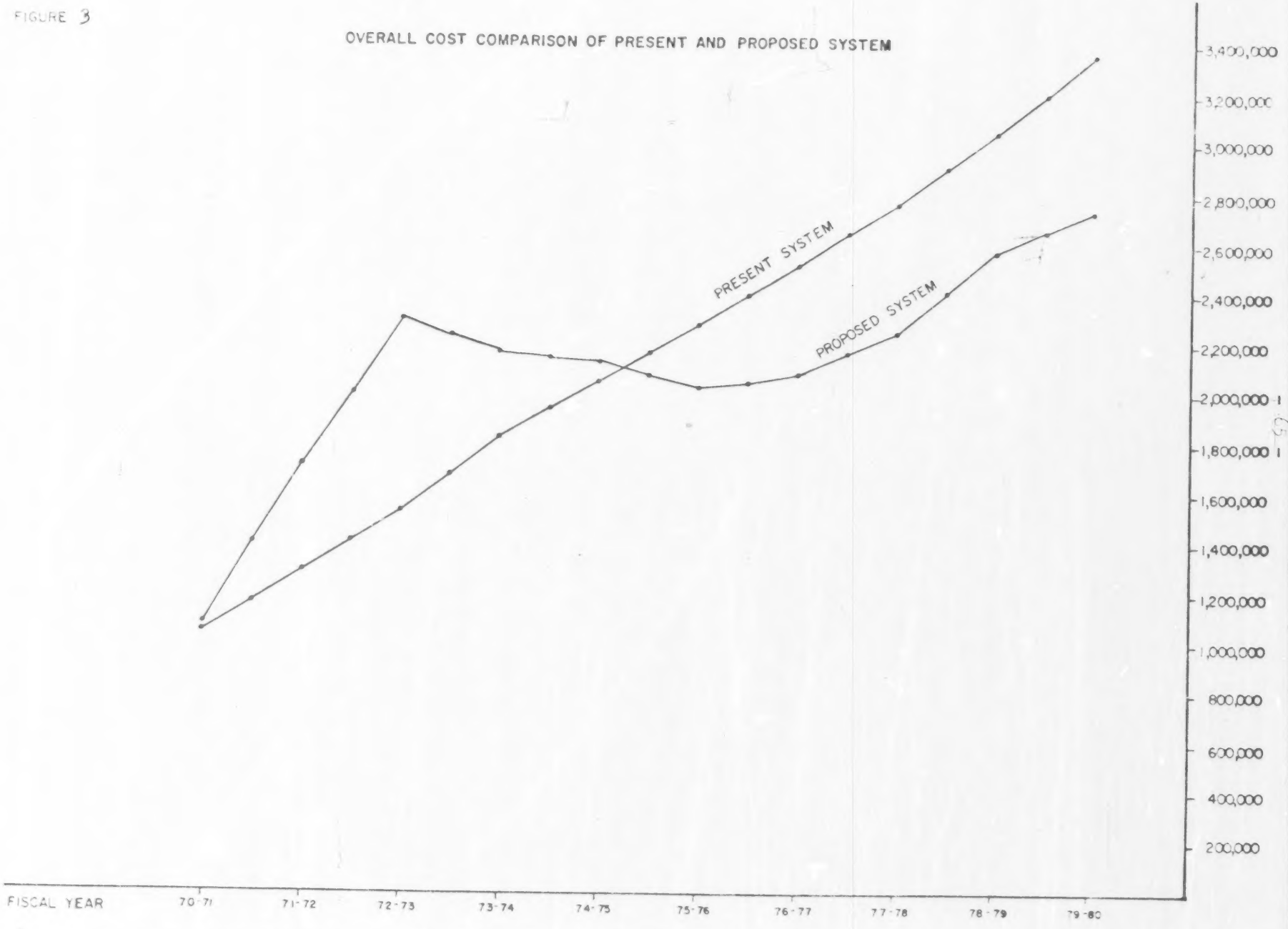
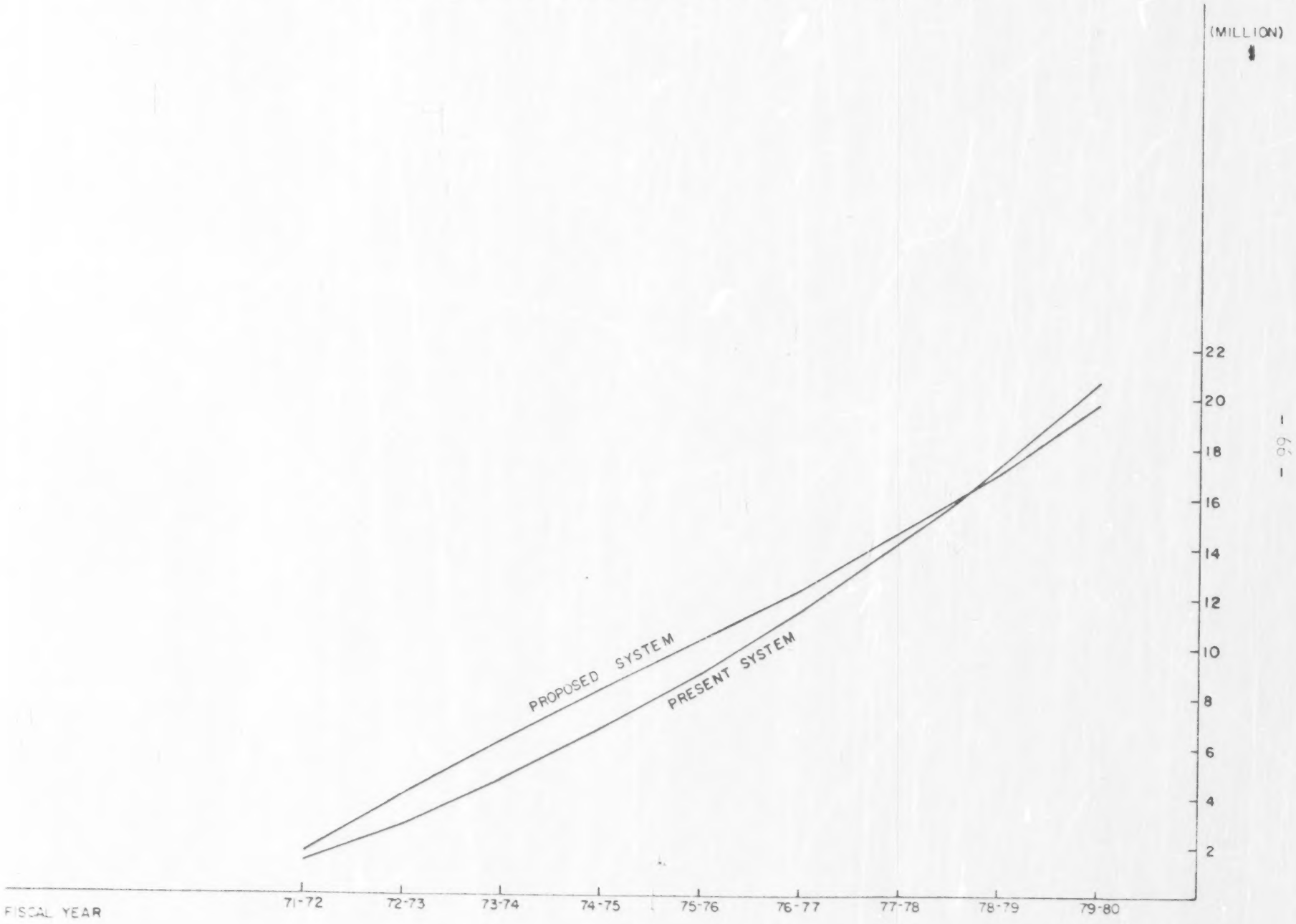

OVERALL COST COMPARISON OF PRESENT AND PROPOSED SYSTEM
PRESENT SYSTEM
PROPOSED SYSTEM
3,400,000
3,200,000
3,000,000
2,800,000
2,600,000
2,400,000
2,200,000
2,000,000
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
FISCAL YEAR
70-71
71-72
72-73
73-74
74-75
75-76
76-77
77-78
78-79
79-80

FIGURE 2.2 COMPARISON OF OVERALL CUMULATED COSTS OF PRESENT AND PROPOSED SYSTEM



PART IV. IMPLEMENTATION

This report has proposed an integrated information system for the National Library and has shown the feasibility of this system from the viewpoints of both hardware and technology available and costs. A suitable schedule for implementing this system must now be considered.

Part III of the report has indicated that following the implementation of the proposed system, some reduction in expenditures can be anticipated in future years. Although this would seem to suggest that the system should be implemented as a whole as quickly as possible, for a number of reasons it is not considered desirable or even feasible to attempt to implement all the modules of the proposed system concurrently. These reasons are:

(a) The impact on the existing operations of the National Library, the effect on its services and on staff morale.

The advent of automation has a considerable and often devasting impact on any organization. It is essential that the National Library continue to provide all its services and continue with its day-to-day operations during the implementation of all parts of the system, otherwise there would be an adverse effect on Canadian research libraries generally. It is most desirable, when an implementation plan and timetable are adopted, that the library community be informed and also that it be kept up-to-date on the progress of the implementation in order to permit maximum opportunity for cooperation and participation in the plan by outside libraries. The development of automation may also have a disruptive effect on the staff of an organization. Despite the fact, that there is very little likelihood that any staff will be displaced by automation, although some may be retrained for new jobs, morale and efficiency may suffer. The implementation of the new system by modules will not disrupt all the staff at one time and will gradually diminish fears

and apprehensions when it is seen that automation of one segment of the National Library system has led to job enhancement rather than layoffs. Staff should be kept informed of plans well in advance of implementation.

(b) The difficulty of establishing a competent data processing organization in a short period of time.

The development of the organization necessary to implement a substantial programme of automation is a complex one and will have a significant effect on the speed with which the implementation can proceed. This report considers that the most satisfactory implementation team will contain computer experts who will have to be recruited from outside the Library, as well as staff which will be drawn from the existing staff of the Library. To define and classify jobs, advertise positions, recruit, replace and train staff will require a considerable time.

(c) The budgetary considerations for the implementation programme.

The costs for developing the proposed system were presented in Part III. The budgetary resources available may well be the determining factor in the speed with which implementation can take place.

Figure 5, Likely implementation timetable, presents a schedule for implementation which is recommended by this report, if the necessary funds can be obtained. As it is not considered feasible to implement all modules of the proposed system concurrently, it is necessary to determine priorities for the implementation of the system. It is recommended that the National Library first get its own house in order in the proposed automated system, before attempting to automate outside services. There are a number of reasons for this, the principal one being that it is better to experiment with and gain experience through the Library's own internal processes than to risk possible disruption of outside services should problems arise.

The first priority for implementation is given to a combination of the Acquisitions and Cataloguing Subsystems, including Canadiana. The reasons for assigning top priority to this module are: these subsystems are chiefly concerned with internal housekeeping; the collection of bibliographical data is initiated in the Acquisitions Subsystem; outputs from these subsystems provide input to later modules; this module will provide bibliographic control over the Library's collection; the MARC format is already available and will be used in this module; the Library has already gained experience in this area in the automation of the Canadiana index; Acquisitions and Cataloguing provide the greatest cumulative savings over the manual system; hardware requirements will be built up gradually, massive on-line storage will not be required, but on-line real-time experience will be gained from the small On Order /In Process File.

The second priority for implementation is assigned to the Union Catalogue. Although this is the area that outside libraries are most eager to see implemented, it will require the development of a complex and original system. Experience gained in the implementation of Acquisitions and Cataloguing will be valuable. Before the Union Catalogue can be automated, policy decisions on its services will have to be made and studies of the uses which Canadian libraries intend to make of a bibliographical data bank will have to be undertaken, as well as research into information retrieval methods. There will also have to be agreements on standards to be used in the Catalogue. Finally, the method recommended for the development of an automated Union Catalogue is by the creation of a data base of retrospective bibliographic data. The earliest possible date to begin building the data base is estimated to be 1972-73; this in effect, sets an earliest beginning date for the implementation of the Union Catalogue Subsystem.

Last priority for implementation is given to the Serials Control and Union Lists Subsystems. This module is scheduled last because of the nature

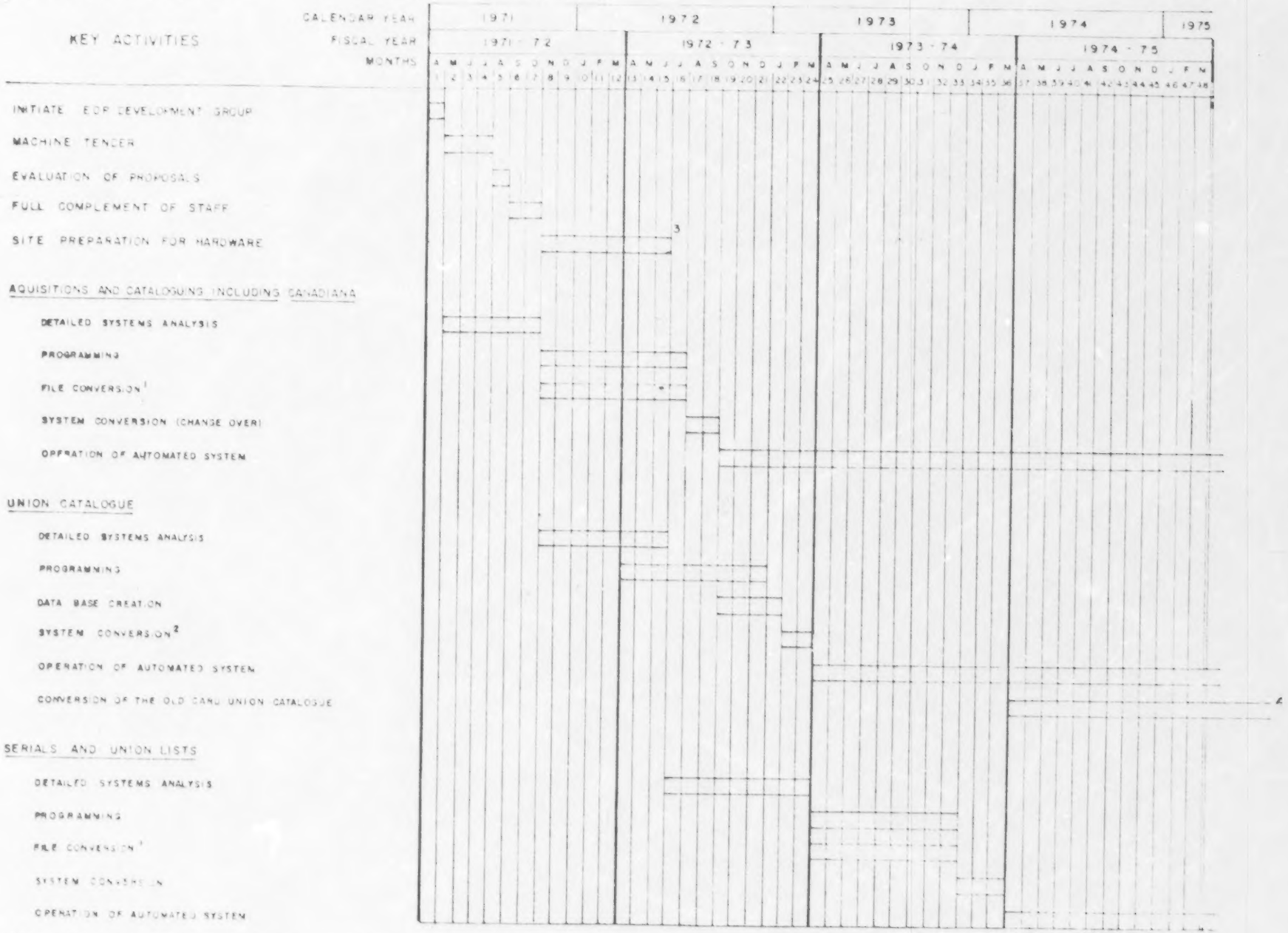
of serials which are more complicated than monographs and considerable experience in machine handling of bibliographical data should be obtained before tackling them. Also MARC and other standards for serials are still in process of development and agreements for standards will have to be worked out with the National Science Library and other Canadian libraries before the module can be implemented.

Thus the order recommended for implementation of the proposed system is:

1. Acquisitions and Cataloguing, including Canadiana
2. Union Catalogue
3. Serials Control and Union Lists.

As the proposed information system affects almost every operation of the National Library and the library community as a whole, the direction and control of the implementation team is a matter of first importance. Thus, the director of the project should report at a level high enough to ensure adequate management involvement and control. It is recommended that the Chief of the Data Processing Centre report directly to the Associate National Librarian.

FIGURE 5: LIKELY IMPLEMENTATION TIMETABLE - NATIONAL LIBRARY


KEY ACTIVITIES
CALENDAR YEAR
FISCAL YEAR
MONTHS
1971
1972
1973
1974
1975
1971 - 72
1972 - 73
1973 - 74
1974 - 75
A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
INITIATE EDP DEVELOPMENT GROUP
MACHINE TENDER
EVALUATION OF PROPOSALS
FULL COMPLEMENT OF STAFF
SITE PREPARATION FOR HARDWARE
3
AQUISITIONS AND CATALOGUING INCLUDING CANADIANA
DETAILED SYSTEMS ANALYSIS
PROGRAMMING
FILE CONVERSION[1]
SYSTEM CONVERSION (CHANGE OVER)
OPERATION OF AUTOMATED SYSTEM
UNION CATALOGUE
DETAILED SYSTEMS ANALYSIS
PROGRAMMING
DATA BASE CREATION
SYSTEM CONVERSION[2]
OPERATION OF AUTOMATED SYSTEM
CONVERSION OF THE OLD CARD UNION CATALOGUE
4
SERIALS AND UNION LISTS
DETAILED SYSTEMS ANALYSIS
PROGRAMMING
FILE CONVERSION[1]
SYSTEM CONVERSION
OPERATION OF AUTOMATED SYSTEM

NOTE 1 CODING AND PROOFREADING DONE IN RESPECTIVE N.L. BRANCHES, KEYBOARDING DONE AT DATA PROCESSING CENTRE

NOTE 2 THE OLD CARD UNION CATALOGUE WILL NOT AT THIS POINT BE INCLUDED IN THE DATA BASE AND WILL CONSTITUTE A SECOND PLACE TO LOOK FOR LOCATIONS

NOTE 3 MACHINES INSTALLED

NOTE 4 THE CONVERSION OF THE OLD CARD UNION CATALOGUE SHOULD BE COMPLETED SOMETIME IN 1975-76

CONCLUSIONS

Necessity of an automated information system for the National Library

A study of the history, present situation and future requirements of the National Library has shown that the use of electronic data processing is absolutely essential if the Library is to continue to carry out its services. The new National Library Act reconfirms and increases the responsibilities of the National Library towards the Canadian library community. If the National Library is not able to fulfill its functions, its responsibilities will be performed by other institutions at a level other than national, and will result in costly duplication of effort and lack of coordination.

There is an international trend towards the formation of library networks based on machine-readable bibliographical data banks; bibliographical data is already being exchanged internationally in machine-readable form. The National Library must be in a position to utilize this machine-readable data, to transfer it to other Canadian libraries on request, to create such machine-readable bibliograpjic data for Canadian publications and to disseminate it on an international basis. Canada cannot afford to be left out of this international library information network.

Technical feasibility of the proposed automated information system

The proposed system is technically feasible with the hardware presently available. While the costs for mass random access storage devices, such as are required for the Union Catalogue, are high, prospects for new and cheaper storage devices becoming available during the implementation period are good. Software development lags behind hardware development, especially software for information retrieval and for library applications, including handling of massive bibliographic data files.

Much research is necessary. Canada and the National Library must expect to break new ground in the development of library software and methodology for use in a bilingual country. The initial expense, if the job is done at the national level, will be less than it would be if a number of large research libraries across the country each tried to work out the problems for themselves.

Financial feasibility of the proposed information system

The implementation of the proposed information system can also be defended on financial grounds. A cost comparison of the present and proposed systems shows a cumulated savings of over $2 million for the period from 1971-72 to 1979-80. The annual operating costs of the proposed system will begin to save money over the present system in 1974-75 and the cumulated costs of the proposed system in comparison with those of the present system will begin to show a benefit in 1978-79.

Additional advantages of the proposed automated information system

Beyond the cost advantage of the proposed system there are additional advantages not offered by a manual system. These should be taken into account in evaluating the benefits of the proposed system. These additional advantages accruing from the proposed system are:

1. Ability to use externally generated bibliographical data in machine-readable form received from other institutions and countries and the capacity to provide other institutions with Canadian bibliographic data in machine-readable form in exchange.

2. Ability to participate in automated library communication networks and data banks and to permit on-line real-time use of National Library files, such as the Union Catalogue, by outside institutions.

3. Provision of leadership, direction and assistance to Canadian libraries in the rapidly expanding field of library automation by a practical display of library systems and programs in operation.

4. Full integration of the internal operating system of the National Library with its system for the provision of outside services. E.g. National Library holdings can be automatically provided as input to such national services as the Union Catalogue and union lists and the National Library, in its own internal cataloguing operations, can make use of the outputs of outside libraries by the use of MARC and other tapes. All inputs and outputs will be compatible.

5. Production of management information reports which can be automatically produced on demand as required by National Library management. Reports will provide control over National Library operations with more accurate and up-to-date data on library performance and operations than are possible in a manual system. Statistics will be produced automatically. Thus management can exercise better control and better data for estimates and forecasting will be provided. Control will include close bibliographical control through the on-line On Order/In Process File; items in process can be constantly monitored and claims automatically produced.

6. Automatic production of lists and bibliographies, as required, from all machine-readable files of the National Library.

7. The automated Union Catalogue can provide reports on the make-up and currentness of Canadian library collections and data which can be used for better control and rationalization of Canadian library collections.

8. An automated Union Catalogue and the provision of MARC records selectively to libraries can be used as a basis for shared cataloguing programme for Canada.

9. Improved response time for basic routines and thus faster and improved services. Greater ease in updating, cumulating and publishing the national bibliography, union lists and other bibliographical tools. Instantaneous location service from the Union Catalogue by multiple approaches. Accessions to the Union Catalogue kept up-to-date. These faster services will reduce the need for original cataloguing in Canadian libraries and improve interlibrary loans.

10. Stabilization and in many cases reduction of unit costs.

11. Use of terminals will permit on-the-spot querying of National Library on-line files by National Library staff, and, for the Union Catalogue, by outside libraries. This will improve the communication of bibliographic data and save the time spent moving to where the physical file is located. This time-saving will be especially effective in the checking of duplicates.

12. Highest possible use of scarce manpower resources. Repetitive manual filing and typing tasks will be reduced and this will prevent backlogs from forming in these areas. Clerical manpower will be freed from many repetitive tasks to perform professional support duties which will in turn allow librarians to concentrate on purely professional tasks and on service to the library community.

13. Avoidance of the need to edit the old manual Union Catalogue in order to convert it to machine-readable form.

14. National Library bibliographic data captured in machine-readable form at the point of origin and passed on to other segments of the system, thus saving constant rekeying of the data. One basic bibliographic record will be produced which will serve all needs. The system provides an integrated flow of bibliographic information throughout all segments of National Library operations.

15. Flexibility of the system which employs both batch and real-time processing according to need and takes advantage of the man-machine interface, combining the high speed of the computer with human skill in manipulating data and forming inquiries. The data base may be expanded and broadened as required to form the basis of a Canadian bibliographical data bank network. The automated system can be more easily expanded, evolved and adapted to suit changing conditions and requirements and to encompass new applications.

LIST OF APPENDICES CONTAINED IN VOLUME 2 OF THE REPORT

A. Description and list of input forms, output reports and machine-readable files

B. Description of records in the proposed information system

C. System flow charts

D. List & description of programs and program flow charts

E. Bibliographic data base file organization

F. The future of the Union List of Serials

G. Supporting cost data and tables

H. Preliminary notes on the feasibility of cooperative cataloguing using a computerized Union Catalogue

I. List of libraries and other institutions visited

J. List of documentation in the working paper files

K. The publication of the Union Catalogue